CIVIL ENGINEERING

Published by the American Society of Civil Engineers

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JANUARY 1946

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Among Our Writers

E. E. MAYO, as Chief Engineer of the Southern Pacific Company, has continued and further developed the tunnel elimination work on the lines of that company initiated under his predecessor, the late W. H. Kirkbride, M. ASCE, and described in this article.

KENNETH C. ROBERTS (Worcester Poly. Inst., B.S. in C.E. '23) following experience in the fields of bridge engineering and industrial and hydraulic structures, joined the staff of the TVA in 1934. He is now Chief of the Structural and Mechanical Design Division.

ARTHUR N. BECK (Ala. Poly. Inst. B.S. in C.E. '28) since graduation has been connected with the Alabama State Health Dept., for the past 5 years as engineer in charge of the water works and sewerage section of the Engineering Division. The supervision and control of all public water supplies are designated by the state legislature to the State Board of Health, which is represented in this capacity by its Engineering Division.

D. B. STEINMAN (College of the City of New York, B.S.; Columbia U., A.M., C.E., Ph.D.) is a well-known authority on the design and construction of long-span bridges. The list of his bridges is a long one and includes many important structures in this country and abroad. In addition he has acted as consultant on the design and construction of many other famous structures.

PHILIP HARRINGTON (Armour Inst. of Tech., B.S. in E.E. '06) has been a member of the technical staff of the Sanitary District of Chicago for 29 years. As chief engineer he directed over $100,000,000 of heavy construction. In 1935 he became Traction Engineer, City of Chicago; in 1938, Commissioner of Subways and Superhighways; and in June 1945, chairman of the Chicago Transit Board.

HOWARD ELLIS DAVIS (Ala. Poly. Inst.) spent 4 years in fiction writing following service in World War I as a major. He began his career as a reservoir engineer in 1923, and later built Martin Dam for the Alabama Power Co. He joined the TVA in 1933, and until July 1945 directed all reservoir clearing operations for dams under construction.

L. H. BERGER is president of the firm of C. L. Berger & Sons, Inc., manufacturers of engineering, surveying, mining and astronomical instruments. Established in 1871, the firm is now carried on by the "sons," Louis Herman Berger, president, and William Albert Berger, treasurer.

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

VOLUME 16 NUMBER 1

January 1946

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Printed in U. S. A.

Entered as second-class matter September 23, 1930, at the Post Office at Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at special rate of postage provided for in Section 1102, Act of October 3, 1917, authorized on July 5, 1918.

CIVIL ENGINEERING

Published Monthly by the

AMERICAN SOCIETY OF CIVIL ENGINEERS
(Founded November 5, 1852)

PUBLICATION OFFICE: 20TH AND NORTHAMPTON STREETS, EASTON, PA.
EDITORIAL AND ADVERTISING DEPARTMENTS:
33 WEST 39TH STREET, NEW YORK 18

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The Society is not responsible for any statements made or opinions expressed in its publications.

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SUBSCRIPTION RATES

Price 50 cents a copy; $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents and foreign postage $1.50 additional.

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Ninety-Third Annual Meeting

Commodore Hotel, New York, N.Y., January 16–19, 1946

Business Meeting, Prize Awards, Conferring of Honorary Memberships

WEDNESDAY—January 16, 1946—Morning

Grand Ballroom

9:00 **Registration in the Grand Ballroom Foyer**

10:00 **Ninety-Third Annual Meeting called to order by**

J. C. STEVENS, *President, American Society of Civil Engineers*

Report of the Board of Direction

Report of the Secretary

Report of the Treasurer

10:30 **Presentation of Society Medals and Prizes**

The Norman Medal to MERRILL BERNARD, *M. ASCE, Hydrologic Director, U.S. Weather Bureau*, Washington, D.C., for Paper No. 2212, "Primary Role of Meteorology in Flood Flow Estimating."

The J. James R. Croes Medal to GEORGE H. HICKOX, *M. ASCE, Senior Hydraulic Engineer, TVA*, Norris, Tenn., for Paper No. 2215, "Aeration of Spillways."

The Thomas Fitch Rowland Prize to DONALD N. BECKER, *M. ASCE, Engineer of Bridge Design, Department of Public Works*, Chicago, Ill., for Paper No. 2226, "Development of the Chicago-Type Bascule Bridge."

The James Laurie Prize to OLE SINGSTAD, *M. ASCE, Consulting Engineer*, New York, N.Y., for Paper No. 2219, "The Queens Midtown Tunnel."

The Collingwood Prize for Juniors to CARL E. KINDSVATER, *Jun. ASCE, Associate Professor, Civil Engineering, Georgia School of Technology*, Atlanta, Ga., for Paper No. 2228, "The Hydraulic Jump in Sloping Channels."

10:45 **Presentation of Division Prizes**

The Karl Emil Hilgard Hydraulic Prize to L. STANDISH HALL, *M. ASCE, Hydraulic Engineer, East Bay Municipal Utility District*, Oakland, Calif., for Paper No. 2205, "Open Channel Flow at High Velocities."

Mr. Hall will be presented to the President by BORIS A. BAKHMETEFF, *Hon. M. ASCE, Professor, Civil Engineering, Columbia University*, New York, N.Y.

The J. C. Stevens Award to THOMAS R. CAMP, *M. ASCE, Consulting Engineer*, Boston, Mass., for Paper No. 2218, "Effect of Turbulence on Sedimentation."

Mr. Camp will be presented to the President by BORIS A. BAKHMETEFF, *Hon. M. ASCE, Professor, Civil Engineering, Columbia University*, New York, N.Y.

The Rudolph Hering Medal to LANGDON PEARSE, *M. ASCE, Sanitary Engineer, Sanitary District of Chicago*, Chicago, Ill., for Second Progress Report of the Committee of the Sanitary Engineering Division on "Advances in Sewage Treatment and Present Status of the Art."

Mr. Pearse will be presented to the President by N. T. VEATCH, *M. ASCE, Consulting Engineer, Black and Veatch*, Kansas City, Mo.

The Construction Engineering Prize to C. GLENN CAPPEL, *M. ASCE, (W. Horace Williams Co., Inc.)*, New Orleans, La., for paper appearing in December 1944 issue of CIVIL ENGINEERING entitled, "Timber Hangar Erected from 16-Story Scaffold."

Mr. Cappel will be presented to the President by CHARLES W. BLACK, *M. ASCE, Vice-President, The Arundel Corporation*, Baltimore, Md.

Presentation of Engineering Societies' Joint Award

The Alfred Noble Prize to AUGUST L. AHLF, *Jun. ASCE, Associate Engineer, U.S. Bureau of Reclamation, Department of Interior*, Denver, Colo., for paper published in October 1944 PROCEEDINGS entitled, "Design Constants for Beams with Nonsymmetrical Straight Haunches."

Mr. Ahlf will be presented to the President by JAMES K. FINCH, *M. ASCE, Professor, Civil Engineering, Columbia University*, New York, N.Y.

11:00 **Conferring of Honorary Memberships**

BORIS A. BAKHMETEFF, *Hon. M. ASCE, Professor, Civil Engineering, Columbia University*, New York, N.Y.

Professor Bakhmeteff will be presented to the President by FRED C. SCOBEY, *Director, ASCE, Senior Irrigation Engineer, Division of Irrigation, Department of Agriculture*, Berkeley, Calif.

CHARLES F. KETTERING, *Hon. M. ASCE, Vice-President and Director, General Motors Corporation; President and Director, General Motors Research Corporation*, Detroit, Mich.

Mr. Kettering will be presented to the President by COL. C. E. DAVIES, *Secretary, American Society of Mechanical Engineers*, New York, N.Y.

CHARLES H. PURCELL, *Hon. M. ASCE, Director, State Department of Public Works*, Sacramento, Calif.

Mr. Purcell will be presented to the President by FREDERICK W. PANHORST, *M. ASCE, Bridge Engineer, State Division of Highways*, Sacramento, Calif.

11:30 **New Business**

Report of Tellers on Canvass of Ballots for Officers

Introduction of President-Elect and New Officers

12:00 **Adjournment for Luncheon**

Wednesday Luncheon—Grand Ballroom—12:45 p.m.

At the close of the Wednesday morning session there will be a luncheon for members, guests, and ladies in the Grand Ballroom, Hotel Commodore.

DR. BORIS A. BAKHMETEFF, *Hon. M. ASCE*, will address the luncheon group on

"Science and Engineering"

Ladies are cordially invited to attend this luncheon with members and guests.

Tickets: $2.00 for members and ladies.
$2.50 for non-members.
$1.00 for students.

Sessions of Technical Divisions—Wednesday Afternoon

JOINT SESSION—CONSTRUCTION AND WATERWAYS DIVISIONS

East Ballroom

CHARLES L. HALL, *Chairman, Executive Committee, Waterways Division, Presiding*

2:30 Introductory remarks

CHARLES L. HALL, *M. ASCE, Colonel, Corps of Engineers, U.S.A., Office, Division Engineer, North Atlantic Division*, New York, N.Y.

2:40 Streamlining the Panama Canal for Maximum Safety and Unlimited Capacity

JOHN G. CLAYBOURN, *M. ASCE, Superintendent, Dredging Division, Panama Canal*, Gamboa, Canal Zone

3:30 Discussion by

HANS KRAMER, *M. ASCE, Brigadier-General, Corps of Engineers, U.S.A. (Retired), Mississippi River Commission*, Vicksburg, Miss.

3:45 General discussion

4:30 Adjournment

SANITARY ENGINEERING DIVISION

West Ballroom

N. T. VEATCH, *Chairman, Executive Committee, Sanitary Engineering Division, Presiding*

2:30 Introductory remarks

N. T. VEATCH, *M. ASCE, Consulting Engineer (Black and Veatch)*, Kansas City, Mo.

2:35 Final Report of the Committee on Organization Financing and Administration of Sanitary Districts

SAMUEL A. GREELEY, *M. ASCE (Greeley and Hansen)*, Chicago, Ill.

3:00 Discussion

3:10 Report of the Committee on Sewerage and Sewage Treatment

LANGDON PEARSE, *M. ASCE, Sanitary Engineer, Sanitary District of Chicago*, Chicago, Ill.

3:35 Discussion

3:45 Final Report of the Committee on Evaluation of Professional Objectives in the Design of Sanitary Engineering Works

THOMAS R. CAMP, *M. ASCE, Consulting Engineer*, Boston, Mass.

4:10 Discussion

4:20 Progress Report of the Committee on Advancement of Sanitary Engineering

GORDON M. FAIR, *M. ASCE, Professor, Sanitary Engineering, Harvard Graduate School of Engineering*, Cambridge, Mass.

4:45 General discussion

5:00 Adjournment

SURVEYING AND MAPPING DIVISION

Rooms B and C

PHILIP KISSAM, *Chairman, Executive Committee, Surveying and Mapping Division, Presiding*

ROUND TABLE CONFERENCE ON POSSIBLE USES OF RADAR IN SURVEYING AND MAPPING

2:30 Introductory remarks

PHILIP KISSAM, *M. ASCE, Associate Professor, Civil Engineering, Princeton University*, Princeton, N.J.

It has been proposed by the Executive Committee of the Surveying and Mapping Division that its session at the 1946 Annual Meeting be devoted to an informal discussion on the possible application of radar in surveying and mapping. There are to be no formal papers, but several leaders in the field will be prepared to present their views, and discussion from the floor will ensue.

4:30 Adjournment

Dinner and Dance

WEDNESDAY—January 16, 1946—Evening

Committee: M. N. QUADE, *Chairman;* EDWARD J. CLEARY, JOHN P. RILEY

7:00 Assembly **7:45 Dinner** **10:00 Dancing**

Dinner will be served promptly at 7:45 p.m. Arrangements have been made for tables seating ten persons and members may underwrite complete tables. Orders to underwrite a table must be accompanied by a check in full and a list of guests.

Tickets will be $6.00 each. Tickets for Juniors, for the Dance only, will be $2.00 per couple.

The seating list for the Dinner-Dance will close at 5:00 p.m., Tuesday, January 15, 1946. Those who purchase tickets after that hour will be assigned to tables in order of purchase. Tickets will be on sale at the Registration Desk until 5:00 p.m., Wednesday, January 16, 1946.

Sessions of Technical Divisions—Thursday Morning

CONSTRUCTION DIVISION

Grand Ballroom

CHARLES W. BLACK, *Acting Chairman, Executive Committee, Construction Division, Presiding*

9:30 Introductory remarks

CHARLES W. BLACK, *M. ASCE, Vice-President, The Arundel Corporation*, Baltimore, Md.

9:40 The Postwar Federal Building Program

W. E. REYNOLDS, *M. ASCE, Commissioner of Public Buildings, Federal Works Agency, Public Buildings Administration*, Washington, D.C.

10:05 Discussion

10:15 The Future of Resource Engineering

KENNETH W. MARKWELL, *M. ASCE, Assistant Commissioner, Bureau of Reclamation*, Washington, D.C.

10:40 Discussion

10:50 Postwar Construction Plans of the Bureau of Yards and Docks

JOHN J. MANNING, *M. ASCE, Rear Admiral, (CEC), U.S. N., Chief, Bureau of Yards and Docks*, Navy Department, Washington, D.C.

11:05 Discussion

11:15 The Corps of Engineers and the Civil Engineering Profession

R. A. WHEELER, *Lieutenant-General, Chief of Engineers, U.S.A.*, Washington, D.C.

11:40 Discussion

11:50 General discussion

12:15 Adjournment

HYDRAULICS DIVISION

East Ballroom

BORIS A. BAKHMETEFF, *Chairman, Executive Committee, Hydraulics Division, Presiding*

9:30 Introductory remarks

WESLEY W. HORNER, *M. ASCE (Horner and Shifrin)*, St. Louis, Mo.

SYMPOSIUM ON HYDROLOGY IN WAR AND PEACE

Session I

Program arranged by the Committee on Hydrology under the auspices of the Hydraulics Division

9:40 Rhine River Flood Prediction Service

FRANKLIN F. SNYDER, *Assoc. M. ASCE, Hydraulic Engineer, War Department, Office of Chief of Engineers*, Washington, D.C.

10:20 Discussion

10:30 Presenting Hydrologic Principles to Juries

ADOLPH F. MEYER, *M. ASCE, Consulting Hydraulic Engineer*, Minneapolis, Minn.

11:10 Discussion

11:20 Extending Stream-Flow Records

WALTER B. LANGBEIN, *Assoc. M. ASCE, Associate Engineer, U.S. Geological Survey*, Washington, D.C.

12:00 General discussion

12:15 Adjournment

SOIL MECHANICS AND FOUNDATIONS DIVISION

Rooms B and C

WILLIAM P. CREAGER, *Chairman, Executive Committee, Soil Mechanics and Foundations Division, Presiding*

9:30 Introductory remarks

WILLIAM P. CREAGER, *M. ASCE, Consulting Engineer*, Buffalo, N.Y.

SYMPOSIUM ON EARTH DAMS

Session I

Program arranged by the Committee on Earth Dams under the auspices of the Soil Mechanics and Foundations Division

9:40 Subcommittee on Pore Water Pressures

The Present Status of the Techniques for Measuring Pore Water Pressures

RALPH B. PECK, *Assoc. M. ASCE, Research Assistant Professor, Soil Mechanics, University of Illinois*, Urbana, Ill.

10:00 Discussion by

J. O. OSTERBERG, *Assoc. M. ASCE, Assistant Professor, Civil Engineering, Technological Institute, Northwestern University*, Evanston, Ill.

KARL TERZAGHI, *M. ASCE, Consulting Engineer and Lecturer, Graduate School of Engineering, Harvard University*, Cambridge, Mass.

10:20 Subcommittee on Structural Design of Earth Dams and Their Foundations

Methods of Determining Stability of Earth Dams

THOMAS A. MIDDLEBROOKS, *Assoc. M. ASCE, Head Engineer, Corps of Engineers; Chief, Soil Mechanics, Geology and Geophysical Section*, Washington, D.C.

10:50 Discussion

11:05 General discussion

11:45 Adjournment

SANITARY ENGINEERING DIVISION

West Ballroom

N. T. VEATCH, *Chairman, Executive Committee, Sanitary Engineering Division, Presiding*

9:30 Plans for Water System Improvements at Philadelphia

EUGENE A. HARDIN, *M. ASCE, Project Engineer, Filtration Plants, Bureau of Water*, Philadelphia, Pa.

10:00 Discussion

10:10 Chicago's South District Water Filtration Plant

W. W. DEBERARD, *M. ASCE, City Engineer, Bureau of Engineering, Department of Public Works*, Chicago, Ill., and

JOHN R. BAYLIS, *Assoc. M. ASCE, Physical Chemist, Bureau of Engineering, Department of Public Works*, Chicago, Ill.

10:40 Discussion

10:50 Probable Future Costs of Sanitary Engineering Works in the Light of Increased Labor Costs and the Effect of Increased Costs on Existing and Future Budgets for Such Work

LOUIS R. HOWSON, *M. ASCE, Consulting Engineer (Alvord, Burdick and Howson)*, Chicago, Ill.

11:10 Discussion

11:20 The Use of DDT in the Control of Insect-Carriers of Disease

F. C. BISHOPP, *Assistant Chief, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U.S. Department of Agriculture*, Washington, D.C.

11:50 General discussion

12:00 Adjournment

Thursday Afternoon Tea for Ladies

Biltmore Hotel, Music Room—3:30 p.m.

A tea, followed by an illustrated introduction to Loyaltex, the friendly yarn, will be held in the Music Room of the Biltmore at 3:30 p.m. Mrs. William Buckley, of Huntington, Long Island, breeder of pedigreed Airedale dogs and owner of Peggy, the International Champion, will present a most unusual display of ingenuity and fashion combined. Mrs. Buckley, one of the founders of "Dogs for Defense," developed a formula for the manufacture of dog hair into cloth. The first spinning was done from the hair of Peggy on a loom of valued antiquity. The first proceeds from the cloth were donated to "Dogs for Defense."

The resultant material presents such beauty of texture that three experts from *Harpers Bazaar* identified it as a rare and exquisite cloth from Europe, and experienced an amazement beyond belief to find it was made of combings from the kennels of dog fanciers. The yarn has been fashioned into suits, dresses, bags, hats, and coats. Men's suits made from the material have passed the severest tailor's test. The leading stylists of New York have been clamoring for the opportunity to offer the yarn for sale to the public.

Mrs. Buckley will present the origin and development of her singular cloth. She will have models to display the garments she originated. She hopes to overcome the objection of hotels to animals and have her handler present her champions. Mrs. Buckley plans a very dramatic presentation for the enjoyment of those who attend this tea. Miss Nancy Craig of WJZ is deeply interested in Loyaltex and, if her commitments permit, will be present at the tea. One of New York's leading lawyers will act as master of ceremonies and himself wear a suit made of Loyaltex.

Sessions of Technical Divisions—Thursday Afternoon

SOIL MECHANICS AND FOUNDATIONS DIVISION

Rooms B and C

WILLIAM P. CREAGER, *Chairman, Executive Committee, Soil Mechanics and Foundations Division, Presiding*

SYMPOSIUM ON EARTH DAMS

Session II

Program arranged by the Committee on Earth Dams under the auspices of the Soil Mechanics and Foundations Division

2:30 Subcommittee on Seepage and Drainage

Progress Report on Studies of Seepage and Drainage in Earth Dams

PHILIP C. RUTLEDGE, *Assoc. M. ASCE, Professor, Civil Engineering, Technological Institute, Northwestern University*, Evanston, Ill.

3:00 Discussion

3:15 Subcommittee on Slope Protection

Current Slope Protection Practice

DOW A. BUZZELL, *M. ASCE, Principal Engineer, Office, Chief of Engineers*, Washington, D.C.

3:40 Discussion by

THOMAS A. MIDDLEBROOKS, *Assoc. M. ASCE, Head Engineer, Corps of Engineers; Chief, Soil Mechanics, Geology and Geophysical Section*, Washington, D.C.

4:00 General discussion

4:30 Adjournment

SANITARY ENGINEERING DIVISION

West Ballroom

N. T. VEATCH, *Chairman, Executive Committee, Sanitary Engineering Division, Presiding*

2:00 Proposed Sewage Works for the South Metropolitan District in Boston

KARL R. KENNISON, *M. ASCE, Chief Engineer, Metropolitan District Water Supply Commission*, Boston, Mass.

2:30 Discussion

2:40 Sanitary Engineering Works in Germany

Sewage Works: ANTHONY J. FISCHER, *Assoc. M. ASCE, Sanitary Development Engineer, The Dorr Company, Inc.*, New York, N.Y.

Water Works: ARTHUR E. GORMAN, *M. ASCE, Director, Water Division, Office of War Utilities*, Washington, D.C.

3:20 Discussion

3:40 Standardized Plans for Sewage Disposal

JOHN R. HOFFERT, *M. ASCE, Assistant Chief Engineer, State Department of Health*, Harrisburg, Pa.

4:20 General discussion

4:30 Adjournment

HYDRAULICS DIVISION

East Ballroom

WILLIAM G. HOYT, *Incoming Chairman, Executive Committee, Hydraulics Division, Presiding*

SYMPOSIUM ON HYDROLOGY IN WAR AND PEACE

Session II

Program Arranged by the Committee on Hydrology under the Auspices of the Hydraulics Division

2:00 Military Water Supplies in the Southwest Pacific Area

A. N. SAYRE, *Geologist, U.S. Geological Survey, Department of the Interior*, Washington, D.C.

2:40 Discussion

2:50 Development of Basic Factors for the Design of Airport Drainage

STIFEL W. JENS, *M. ASCE, Associate Consultant (Horner and Shifrin)*, St. Louis, Mo.

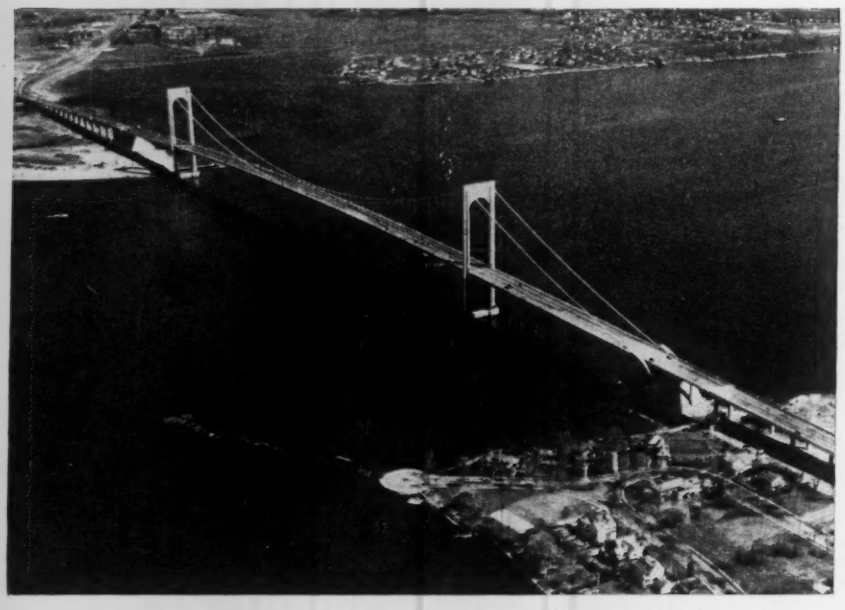
3:30 Discussion

3:40 The Dimensionless Hydrograph for Overland Flow

CARL F. IZZARD, *Assoc. M. ASCE, Highway Engineer, Public Roads Administration, Federal Works Agency*, Washington, D.C.

4:30 General discussion

4:45 Adjournment



BRONX-WHITESTONE BRIDGE ACROSS THE EAST RIVER, NEW YORK, N.Y.

Members are requested to assist the Committee on Local Arrangements by registering and obtaining tickets to social functions and entertainments as early as possible.

Dinner-Smoker for the Men

Grand Ballroom—Commodore Hotel

THURSDAY—January 17, 1946—Evening

Committee: CLINTON A. WRIGHT, *Chairman;* A. K. BURNHAM, CARL H. GRONQUIST

6:30 Dinner

8:30 Entertainment

The Annual Dinner-Smoker will be held on Thursday evening in the Grand Ballroom of the Commodore Hotel. Dinner will be served promptly at 6:30 p.m. and will be followed at 8:30 p.m. by an interesting program of entertainment.

Ladies' tickets—Because of the anticipated interest of the ladies in the entertainment to be provided at the Dinner-Smoker this year, ladies will be admitted for the entertainment to begin at 8:30 p.m. Ladies' tickets are $1.00 each. These tickets are to be presented at the balcony of the Ballroom at the Commodore between 8:15 p.m. and 8:30 p.m.

Members' tickets, $3.00.

Guest tickets, $4.00.

Student tickets, $1.50.

Trips to Places of Special Interest in New York

During the three days of the Annual Meeting, trips for ladies to places of special interest in New York will be organized as desired. The following places are listed as suggestions. No special transportation is being provided.

Empire State Building Observation Tower

The Empire State Building is at 34th Street and Fifth Ave. The tower is open from 9:30 a.m. to midnight. The charge is $1.20 per person.

Rockefeller Center

Rockefeller Center, between Fifth and Sixth Avenues and 48th and 51st Sts., contains several places of interest for which regular guided tours are available. Among them is the N.B.C. Studio-Television Tour, which takes groups actually behind the scenes of radio broadcasting and television. Groups for this tour leave the Studio Section of the R.C.A. Building every twenty minutes from 9:00 a.m. to 11:00 p.m. every day in the year, the tour taking one hour and the charge being 60¢ per person, or 45¢ per person for groups of 10 or more. Tickets at the 45¢ rate may be arranged for through the Society, whether by group or individually.

The Museum of Modern Art

The Museum of Modern Art is at 11 West 53rd St., just west of Fifth Ave. The regular admission charge is 30¢. A gallery talk and guided tour of the museum starts promptly at 2:00 p.m. and 4:00 p.m. on Friday, January 18. The regular film showings are at 3:00 and 5:30 p.m. On Wednesday and Thursday, January 16 and 17, *Grass* (1925), a documentary film—new style will be shown. On Friday, January 18, *Moana* (1926) will be the film.

American Museum of Natural History

The American Museum of Natural History is at Central Park West and 79th St. It is open from 10 a.m. to 5 p.m. and admission is free. The 81st St. Station of the Independent Subway has an entrance into the museum.

Metropolitan Museum of Art

The Metropolitan Museum of Art provides a daily program of educational lectures. Special exhibitions through January include Chinese Ceremonial Vases and Prints of the time of Counter Reformation. Galleries of Greek Art on the South End of the first floor are now reinstalled. Admission to the museum is free. The museum restaurant serves luncheon up to 3:00 p.m. The museum, which is at 82nd Street and Fifth Ave., may be reached by Fifth Ave. buses Nos. 2, 3, or 4.

Broadcasts and Television

It is expected that tickets for a number of radio and television broadcasts will be available. These may be obtained at the registration desk.

The Frick Collection

The Frick Museum includes masterpieces by old and newer painters, rich furnishings, etc., and is on exhibition 10:00 a.m. to 5:00 p.m. at 1 East 70th St., just east of Fifth Ave., reached by Fifth Ave. buses Nos. 2, 3, or 4. Organ recitals are given at 11:00 a.m., 1:30, and 4:00 p.m. and there is a regular lecture at 3 p.m. each Wednesday through Saturday. Admission is free.

Museum of the City of New York

The Museum of the City of New York is a historical museum of the city. Of special interest to ladies would be the exhibits of costumes, interior furnishings, toy shop, and silverware. A specially conducted tour can be arranged for a group of ladies for a morning or afternoon. The Museum is at Fifth Ave. and 104th St., and is reached by Fifth Ave. buses Nos. 2, 3, or 4.

Cathedral of St. John the Divine

The Cathedral of St. John the Divine is at Amsterdam Ave. between 110th and 113th Sts. The Cathedral, which is still under construction (the cornerstone having been laid in 1892), when completed will be the largest Gothic Cathedral in the world. It is open to visitors from 7 a.m. to 6 p.m., guided tours being conducted at 11 a.m., 12 noon, 2, 3, and 4 p.m. daily. Enter by the 112th St. entrance. The Cathedral is reached by Fifth Ave. bus No. 4 or by Eighth Ave. subway and buses at 110th St., and by Broadway surface cars or subway (1 block west at 110th St.).

St. Patrick's Cathedral

St. Patrick's Cathedral, located on Fifth Ave. between 50th and 51st Sts., is open to visitors from 6 a.m. to 10 p.m.

TRIBOROUGH BRIDGE, NEW YORK, N.Y.

Sessions of Technical Divisions—All Day Friday

FRIDAY—January 18, 1946—Morning

ENGINEERING ECONOMICS DIVISION

East Ballroom

JONATHAN E. TEAL, *Member, Executive Committee, Engineering Economics Division, Presiding*

9:30 Remarks on "The Economic Importance of Ground Water"
ERNEST W. BENNISON, *Assoc. M. ASCE, Office Engineer, Edward E. Johnson, Inc.*, St. Paul, Minn.

9:45 The Construction of Water Wells
JAMES C. HARDING, *M. ASCE, Commissioner of Public Works, Westchester County*, White Plains, N.Y.

10:10 Discussion

10:20 The Hydraulics of Water Wells
CARL ROHWER, *M. ASCE, Senior Irrigation Engineer, Division of Irrigation, Soil Conservation Service, U.S. Department of Agriculture*, Fort Collins, Colo.

10:45 Discussion

10:55 Developments in Deep-Well Type Pumping Equipment
ROBERT S. CHARLES, *M. ASCE, President, Layne-New York Company, Inc.*, New York, N.Y.

11:20 Discussion

11:30 General discussion

12:00 Adjournment

JOINT SESSION—HIGHWAY AND CITY PLANNING DIVISIONS

West Ballroom

DAY OKES, *Chairman, Executive Committee, Highway Division, Presiding*

SYMPOSIUM ON TRAFFIC CONGESTION—What Can Be Done About It?

SESSION I

9:30 Introductory remarks
DAY OKES, *Assoc. M. ASCE, President, Okes Construction Company*, St. Paul, Minn.

9:40 Statement of the Problem
LESLIE WILLIAMS, *Assoc. M. ASCE, City Planning Engineer, American Transit Association*, New York, N.Y.

9:55 Parkways and Freeways
WILLIAM S. CHAPIN, *Consulting Engineer, Tri-Borough Authority, New York City Tunnel Authority*, Randall's Island, New York, N.Y.

10:10 New and Modernized Transit
WALTER J. MCCARTER, *General Manager, Cleveland Transit System*, Cleveland, Ohio

10:25 Off-Street Auto, Bus and Truck Terminals
F. W. LOVEJOY, *Executive Secretary, Joint Committee on Parking, Public Roads Administration, Federal Works Agency*, Washington, D.C.

10:40 Traffic Engineering and Enforcement
ROBERT A. MITCHELL, *Chief, Bureau of Traffic Engineering, Department of Public Safety*, City Hall, Philadelphia, Pa.

10:55 City Planning, Zoning and Housing
H. EVERT KINCAID, *Executive Director, Chicago Plan Commission*, Chicago, Ill.

11:10 General discussion

11:45 Adjournment

FRIDAY—January 18, 1946—Afternoon

JOINT SESSION—HIGHWAY AND CITY PLANNING DIVISION

West Ballroom

WILLIAM J. SHEA, *Chairman, Executive Committee, City Planning Division, Presiding*

2:00 Public Works Programs in Relation to Urban Planning
GEORGE H. FIELD, *Commissioner, Bureau of Community Facilities, Federal Works Agency*, Washington, D.C.

2:30 Discussion

3:00 Urban Redevelopment—What is the Practicable Answer?
M. C. LUBAR, *Vice-President, Communities Redevelopment Corporation*, New York, N.Y.

3:30 Discussion

4:00 Adjournment

POWER DIVISION

East Ballroom

ARTHUR T. LARNED, *Chairman, Executive Committee, Power Division, Presiding*

2:00 Introductory remarks
ARTHUR T. LARNED, *M. ASCE, Chief Civil Engineer Ebasco Services, Inc.*, New York, N.Y.

2:10 Reservoir Operation in the Northwest Power Pool
E. N. PETERSON, *Hydraulic Engineer, Ebasco Services, Inc.*, Portland, Ore.

2:50 Discussion

3:00 Recent Progress in the Design of Hydraulic Turbines
FRANK H. ROGERS, *Manager, I. P. Morris Department, Baldwin Locomotive Works, Baldwin-Southwark Division*, Philadelphia, Pa.

3:40 Discussion

3:50 General discussion

STRUCTURAL DIVISION

Grand Ballroom

CHARLES A. ELLIS, *Chairman, Executive Committee, Structural Division, Presiding*

2:00 Introductory remarks
CHARLES A. ELLIS, *M. ASCE, Professor, Structural Engineering, Purdue University*, West Lafayette, Ind.

2:10 Theory of Limit Design
JOHN A. VAN DEN BROEK, *M. ASCE, Professor, Engineering Mechanics, University of Michigan*, Ann Arbor, Mich.

2:50 Discussion

3:30 Application of Plastic Theory to Reinforced Concrete Members
CHARLES S. WHITNEY, *M. ASCE, Consulting Engineer*, Milwaukee, Wis.

4:10 Discussion by
HERBERT J. GILKEY, *M. ASCE, Professor and Head, Department of Theoretical and Applied Mechanics, Iowa State College*, Ames, Iowa

5:00 Adjournment

College Reunions Throughout the Week

THURSDAY—January 17, 1946

Luncheon of Chi Epsilon Honorary Civil Engineering Fraternity

For the twelfth consecutive year, members of Chi Epsilon, their families and friends, will meet for a very informal luncheon in the College Room at the Midston House, 22 East 38th St., New York, N.Y., on Thursday at 12:45 p.m. The charge will be $1.50 per person. Make reservations through R. I. Land, % Abraham and Straus Co., 422 Fulton St., Brooklyn, N.Y. (Triangle 5-7200, Ext. 649), or Harold T. Larsen, Room 1610, Engineering Societies Building (Pennsylvania 6-9220, Ext. 123).

University of Illinois Civil Engineering Alumni Dinner

The University of Illinois Civil Engineering Alumni and their friends will meet for the seventeenth annual informal dinner at 6:30 p.m., on Thursday at the Dinner-Smoker, Commodore Hotel. A private dining room has been reserved on the same floor as the Dinner-Smoker. Dinner-Smoker tickets are $3.00 for members and $4.00 for guests of the Society. All tickets should be ordered from Society Headquarters, and if you wish to join the Illinois group, send your name to Harold T. Larsen (Pennsylvania 6-9220), Room 1610, Engineering Societies Building, New York, N.Y., or to M. N. Quade, Parsons, Brinkerhoff, Hogan and Macdonald, 142 Maiden Lane, New York, N.Y., phone Whitehall 3-0820.

Luncheon of M.I.T. Engineers

The annual M.I.T. Alumni Luncheon will be held at the Engineers' Club, 32 West 40th St., New York, N.Y., on Thursday, January 17, at 12 o'clock. Please notify the Technology Club as to attendance (Caledonia 5-7424).

FRIDAY—January 18, 1946

Cornell Society of Engineers

A buffet supper meeting of the Cornell Society of Engineers will be held on Friday, January 18, 1946, at 6:30 p.m., at the Cornell Club, 107 East 48th St., New York, N.Y. Speaker will be Dean Irving M. Ives of the New York State School of Industrial and Labor Relations at Cornell University, who will discuss the purposes and plans of this recently established school. Buffet supper is $2.00. All Cornell engineers, whether members of the Society or not, are cordially invited. Make reservations through Paul Reyneau, Secretary, Cornell Club (Plaza 5-7210).

Dartmouth Society of Engineers

The Annual Meeting and Dinner of the Dartmouth Society of Engineers will be held at the Dartmouth College Club, 37 East 39th St., New York, N.Y., on Friday, January 18, at 6:30 p.m.

SATURDAY—January 19, 1946

Clarkson College Alumni Association

The New York Section of the Clarkson College Alumni Association will hold its next annual dinner at the Midston House, 22 East 38th St., New York, N.Y., on Saturday, January 19, 1946, at 7:00 p.m. There will be a business meeting of the officers of the association at the same place at 2:00 p.m. Further details may be obtained by phoning Dr. Charles Armstrong Pohl at Cortland 7-8096.

MONDAY—January 21, 1946

Columbia Engineers

The graduates of Columbia University in the field of Civil Engineering will meet for their twenty-fifth annual informal dinner on Monday, January 21, 1946, at the Faculty Club, Columbia University, 117th St. and Morningside Drive, at 6:30 p.m. The program for the evening will be devoted to the contribution of advanced mathematics and mechanics to engineering progress, in honor of Boris A. Bakhmeteff, Professor of Civil Engineering, who will this year receive the highest award which the American Society of Civil Engineers can bestow, Honorary Membership. The charge of $2.00 per cover will be collected at the dinner.

New York University Civil Engineering Alumni

The Annual Dinner of the New York University Civil Engineering Alumni will be postponed until later in the year, at which time full information will be mailed to the alumni.

Meeting of the New York State Sewage Works Association

Salle Moderne—Hotel Pennsylvania—Seventh Avenue and 33rd Street

All Members of the Sanitary Engineering Division of the American Society of Civil Engineers Are Cordially Invited

FRIDAY—January 18, 1946—All Day

8:30 Registration—Foyer of Salle Moderne, Hotel Pennsylvania

10:00 Annual Business Meeting—Salle Moderne

Committee Reports

Report of Tellers on Canvass of Ballots

Technical Sessions

10:45 Air Flocculation of Sewage

UHL T. MANN, *Chief Operator, Ley Creek Sewage Treatment Plant*, Syracuse, N.Y.

Discussion by

LLOYD R. SETTER, *Principal Sanitary Chemist, Department of Public Works*, New York, N.Y.

12:00 Luncheon—Penn Top

Presentation of Awards

The Federation

WILLIAM H. WISELY, *M. ASCE, Executive Secretary-Editor, Federation of Sewage Works Associations*, Champaign, Ill.

Address—"Cooperative Sanitation in the Americas"

HAROLD B. GOTAAS, *M. ASCE, Lt. Col., Sanitary Corps U.S.A., Director, Division of Health and Sanitation, Office, Coordinator of Inter-American Affairs*, Washington, D.C.

2:15 Impressions of Postwar Germany (Illustrated)

ANTHONY J. FISCHER, *Assoc. M. ASCE, Sanitary Development Engineer, The Dorr Company, Inc.*, New York, N.Y.

3:00 Solids Removal as Influenced by Sewage Treatment Plant Design

THOMAS M. RIDDICK, *Assoc. M. ASCE, Consulting Engineer and Chemist*, New York, N.Y., and

H. O. JOHNSON, *Superintendent of Sewage Treatment, Belgrave Sewer District*, Great Neck, N.Y.

3:45 Grit Collection and Conditioning

ROBERT C. MERZ, *Assoc. M. ASCE, Sanitary Engineer, Chain Belt Company*, Milwaukee, Wisc.

4:30 Thumbnail Sketches of War Zone Sanitation (Our Returned Veterans' Impressions)

5:15 Adjournment

Note: On Saturday, January 19, there will be no organized inspection trip largely owing to transportation restrictions.

Excursion on Saturday

Morning and Afternoon—January 19, 1946

Committee: JOHN P. RILEY, *Chairman;* EDWARD J. CLEARY AND L. H. CSANYI

The party will leave the Commodore Hotel at 9:00 a.m. by bus, traveling over the Williamsburg Bridge to the New York Navy Yard. Arrangements have been made to stop there for inspection of the famous U.S. carrier *Franklin*. If the battleship *Missouri* is still in port, it may be possible for the party to visit the spot of the surrender in Tokyo Bay.

From the Navy Yard the party will travel by such route as to give a comprehensive view of that portion of the city between the Navy Yard and Idlewild Airport. At Idlewild the party will stop for a brief tour of the largest civil airport in the world, which is still under construction. Individual flights may be in process.

From Idlewild the party will proceed by such routing as to give a view of other parts of the city, arriving at LaGuardia Field in time for luncheon. Through the courtesy of the American Airlines, a typical flight luncheon, such as is served in the air, will be provided in the Terrace Restaurant. Guests will have an opportunity to watch flight operations during luncheon. In addition, the American Airlines has arranged for a brief guided tour through its operation center, a typical hangar, a repair shop in operation, and its Flight Control Office. Since this is the largest civil airport in full operation, those taking the tour will be able to grasp the greatly expanded facilities represented by Idlewild Airport.

The party will return by bus to the Commodore Hotel by mid-afternoon.

Members and their wives are cordially invited to attend.

The price per person will be $2.00. Since both transportation and luncheon facilities are limited, reservations close at 12:00 noon, January 16, 1946, and will be accepted in advance by mail.

General Announcements

Your New York Address

At the Registration Desk a card file of those in attendance will be maintained, with information as to members' hotel addresses in New York. Members are requested to keep Society Headquarters informed as far as possible of their New York addresses so as to expedite the delivery of telegrams, telephone messages, and mail.

Regional Meeting Committee

This program has been prepared under the direction of the Committee on Regional Meetings, RICHARD E. DOUGHERTY, *Vice-President, ASCE, Chairman;* and R. E. BAKENHUS, CHARLES W. BRYAN, JR., DEAN G. EDWARDS, THORNDIKE SAVILLE, CHARLES B. BREED, S. C. HOLLISTER, *Directors, ASCE.*

Committee on Local Arrangements for the Annual Meeting

LAWRENCE S. WATERBURY, *Chairman*
ALFRED HEDEFINE, *Vice-Chairman*
RALPH H. MANN, *Past-Chairman*

A. K. BURNHAM
EDWARD J. CLEARY
L. H. CSANYI
CARL H. GRONQUIST
M. N. QUADE
HERBERT RIDGWAY
JOHN P. RILEY
CHARLES W. WILLIAMS
CHILTON A. WRIGHT

Headquarters Hotel

The Commodore Hotel has been designated as Headquarters Hotel for the Annual Meeting. All functions, both technical and social, in connection with the 1946 Annual Meeting will be held at the Commodore, beginning Wednesday, January 16.

Ladies' Headquarters—Commodore Hotel

Room F on the Ballroom floor has been assigned as headquarters for the ladies for Wednesday and Thursday, January 16 and 17 and until noon on Friday, January 18.

Junior Members

LT. WILLIAM J. ARMENTO
NATHAN BRENNER
EDWIN M. ERICKSON
JOSEPH M. KENNEDY
CHARLES A. KNAPP
LT. JAMES A. LINDSAY
EDWARD LUSTBADER
JOSEPH MCCABE
CARL S. RUPP
MICHAEL YATSKO

Ladies Committee

MRS. LAWRENCE S. WATERBURY, *Chairman*

MRS. R. E. BAKENHUS
MRS. CHARLES W. BRYAN, JR.
MRS. A. K. BURNHAM
MRS. EDWARD J. CLEARY
MRS. L. H. CSANYI
MRS. DEAN G. EDWARDS
MRS. CARL H. GRONQUIST
MRS. ALFRED HEDEFINE
MRS. HAROLD M. LEWIS
MRS. HARRY O. LOCHER
MRS. RALPH H. MANN
MRS. M. N. QUADE
MRS. HERBERT RIDGWAY
MRS. JOHN P. RILEY
MRS. THORNDIKE SAVILLE
MRS. WILLIAM J. SHEA
MRS. CHARLES E. TROUT
MRS. HAROLD E. WESSMAN
MRS. CHARLES W. WILLIAMS
MRS. CHILTON A. WRIGHT

VIEW OF NEW YORK FROM LONG ISLAND CITY, N.Y.

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Volume 16 · January 1946 · Number 1

Railroad Tunnels "Daylighted" by Company Forces

Close Clearances in Southern Pacific Tunnels Eliminated

By E. E. Mayo
Chief Engineer, Operating and Maintenance Department, Southern Pacific Lines, San Francisco, Calif.

On the main San Joaquin Valley line of the Southern Pacific between San Francisco and Los Angeles there were six restrictive tunnels in 1942. On other routes of the company there were also "tight" spots that threatened to limit the traffic to be imposed by the war. Instead of enlarging the tunnels, it was decided that it would be much more desirable to eliminate them altogether by "daylighting," or excavating through the overburden to grade. Cost figures demonstrated the economy of this alternative. Perhaps a factor in the relative costs was the use of company forces to carry out the excavation work.

DURING the past few years the Southern Pacific Company has done a considerable amount of tunnel-elimination work to remove restrictive clearances. With the outbreak of World War II, it became more than ever desirable to remove impairments on the standard clearance diagram. The present program of eliminating restrictive tunnels was commenced in 1942, and since that time eight restrictive tunnels have been eliminated. The most outstanding feature of the work is the fact that the grading has been performed by the railroad's own forces.

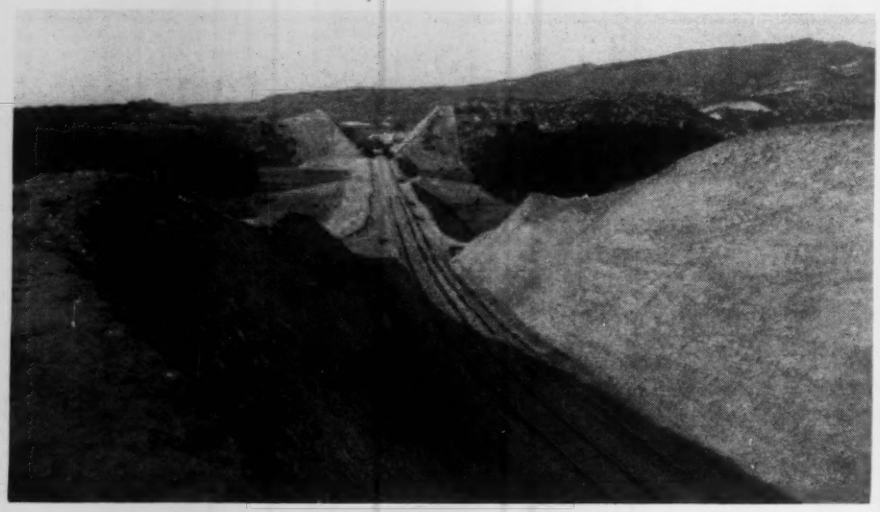
By 1942 only six restrictive tunnels remained on the company's San Joaquin Valley main line between San Francisco and Los Angeles, Calif., which is predominantly single track. The restrictive tunnels were Nos. 17½, 20, 21, 22, 23, and 24. They were all in Soledad Canyon, in a section about 16 miles long, between the stations of Russ and Saugus, Calif. This section was surveyed, and definite location staked, in 1871 and 1872. Grading was started in 1875 and completed in 1876. The clearances were 17 ft in height from top of rail to the timbers at the top of the tunnel. Standard clearance is 22 ft. Before the restrictive clearances were removed, it was necessary to refuse a large number of loads which could not be handled because of the insufficient height of the tunnels. Since the small tunnels have been removed, we can now handle over this line any loads foreign lines can deliver.

At one time the line had 26 tunnels, all in two relatively short sections. One of these sections was where it traverses the Tehachapi Mountains, and the other where it follows the Santa Clara River in Soledad Canyon. Most of these tunnels were constructed with timber linings. Eventually, because of the dimensions of the loads carried, the clearances in the original tunnels became restrictive. To permit these larger loads to be handled, the company has been enlarging the tunnels to obtain standard clearances. In connection with this enlargement work, since 1916, the timber linings have been gradually replaced with concrete. Since the 1942 program was instituted, however, the plan has been to eliminate restrictive tunnels altogether, either by "daylighting" or by making line changes.

Besides the six tunnels in the Soledad Canyon section, eliminated in connection with this program, a number of restrictive tunnels elsewhere on the system have been marked for elimination. This latter group includes that known as No. 13, on the company's Coast route between San Francisco and Los Angeles. Located between Drake and Sacate, this 715-ft tunnel, lined with redwood, was constructed in 1900. The timber had reached the end of its service life, although it was still in fair condition because the tunnel was well ventilated. Since the tunnel was restrictive, it was decided to eliminate it instead of merely renewing the lining. A large amount of second-hand lumber was salvaged for use elsewhere.

Remnant of Tunnel 13 on the Southern Pacific Yields to Efforts of "Daylighting" Crew

Another tunnel in the restrictive category was known as tunnel No. 0, on the main line of the Sacramento Division, which is a link in the Southern Pacific Company's part of the Overland Route, between San Francisco and Chicago. This tunnel was in double-track territory, and a part of the westward main track at a point where the westward and eastward main tracks are not parallel but follow divergent routes. It was between Clipper Gap and Applegate, at milepost 132.6, and its length was 711.1 ft, lined throughout with stone masonry and concrete. It was constructed in 1873. The eastward main track in this vicinity is carried by a standard-section, concrete-lined tunnel known as No. 23 (at milepost 132.7), which was built in 1911 when the second track was put through from Rocklin to Colfax, Calif.



TWO DEEP CUTS ON LINE CHANGE ELIMINATE TUNNELS 21 AND 22 ON THE SAN JOAQUIN DIVISION

Work on these eight tunnel-elimination projects (the six tunnels on the San Joaquin Valley main line, plus the two just described) is now completed. However, there still remain other main-line tunnels having restrictive clearances, and at an opportune time they will require elimination either by a line change or by "daylighting."

CENTRALIZED TRAFFIC CONTROL INSTALLED

Recent tunnel-elimination work included another tunnel, although not because it had restrictive clearances. In this case the elimination was required to extend an adjacent siding in connection with the installation of a centralized traffic-control system. This was tunnel No. 11 (at milepost 353.0) on the San Joaquin Valley line, in the Tehachapi Mountains between Walong and Marcel stations, California. This tunnel—121 ft long, in solid rock, unlined—was eliminated under contract by the construction of a line change 0.2 mile long, which involved the removal of 18,350 cu yd of material.

This method of completely eliminating restrictive tunnels instead of enlarging the existing cross section, was adopted because modern earth-moving equipment and methods have so greatly reduced the cost of grading that, considering all factors, it is the most economical solution where conditions are favorable. This method also has the advantage that it permits changes in alinement if the existing line through the tunnel has excessive curvature.

The tunnel-elimination work on the Southern Pacific is also of interest because all the grading—except at tunnel No. 11, as previously mentioned—has been performed by the railroad's own forces, and using the company's own equipment. It was necessary to use company forces and equipment because, when this work started, contractors were reluctant to bid on railroad jobs because of the large volume of work on Army camps, airports, etc. We were therefore unable to secure satisfactory bids. Our own forces and equipment were able to handle the work economically and expeditiously. A grading organization embodying tractor-drawn carryalls for excavating and hauling the material was used at seven locations, that is, at the six tunnels on the San Joaquin Valley line, and at tunnel No. 13 on the coast route. At these locations the material encountered was such that it could readily be handled by equipment of this type, with the aid of a rooter for loosening it. However, at tunnel No. 0 on the main line of the Sacramento Division, the material to be moved consisted largely of solid rock, which required blasting. To handle the grading on this job, the railroad used dump trucks, and loaded the material with a crawler shovel. It was necessary to organize separate gangs for rock excavation, since it was not possible to use the same forces for this work and for earth moving.

The first grading project accomplished with carryalls was done in 1942 with a small organization, using only carryalls and tractors. Since that time additional machines have been added until at present the organization contains five units of this type. The first tunnel to be eliminated with this organization was No. 23, 189 ft long, on the San Joaquin Valley line. This tunnel was eliminated by converting it into an open cut, that is, by "daylighting" on the original alinement, an undertaking that entailed the handling of 26,000 cu yd of material.

Interruption of traffic over a line during daylighting work was generally avoided. In most instances it was possible to improve the alinement of the track in such a way that the excavation could be placed at one side of the existing tunnel, thus permitting traffic to continue through the tunnel until the new alinement could be connected up. In the case of two of the tunnels, it was necessary to daylight on the existing alinement. At these locations the excavation was first carried down to the top of the existing tunnel sets. Then traffic was handled by slow orders and flagging, and the timber sets were removed a few at a time between trains.

MAINTENANCE EQUIPMENT USED

In 1942, when the company decided to perform the grading work on the tunnel-elimination jobs with its own forces, it had available 11 carryalls, but most of them had been obtained previously for maintenance work, and the majority were not large enough to be used economically on heavy grading. Two of them, however, of 12-cu yd capacity, were considered sufficiently large to warrant their use on the tunnel work. Therefore when the grading was undertaken at tunnel No. 23, the organization was built around these two carryalls (each drawn by a 95-hp tractor), plus a 95-hp and a 54-hp tractor, both equipped with bulldozer blades. The 95-hp tractor was used principally for pulling a rooter and pushing the carryalls while loading; the 54-hp tractor was used for spreading and shaping the work.

The second tunnel to be eliminated in this project was No. 13 on the Coast route, previously described. Like No. 23 on the San Joaquin Valley line, it was eliminated by converting it to an open cut on its original alinement, which required the moving of 174,350 cu yd of material. This tunnel work was handled by the same grading organization and equipment used on tunnel No. 23, with the addition of an 8-cu yd carryall drawn by an 80-hp tractor, rented for the purpose.

When work on tunnel No. 13 was completed, the grading organization and equipment returned to the San Joaquin Valley line to undertake the elimination of tunnel No. 24 at milepost 449.7, between Honby and Saugus. This tunnel was constructed in 1890 on a curved alinement, consisting of 114 ft on a 10° 10′ curve, and 141 ft on a 6° 00′ curve, a total length of 255 ft. It was lined throughout with timber portals, and was of restrictive clearance. It was eliminated by a line change 0.5 mile long on an improved alinement, which required about 62,700 cu yd of grading. The only change in the grading organization from that used on tunnel No. 13 was the substitution of a newly purchased company-owned unit to replace the 80-hp tractor used to draw the 8-cu yd carryall. The new acquisition was a 70-hp Diesel tractor.

RESTRICTIVE TUNNELS 0 AND 23 AT CLIPPER GAP ARE BY-PASSED BY RELOCATION OF MAIN LINE

OTHER TUNNELS ELIMINATED BY LINE CHANGES

Next, the organization was moved to the site of tunnel No. 20, about 10 miles north of tunnel No. 24 (milepost 439.5) between Lang and Humphreys on this same main line. Tunnel No. 20 was constructed in 1890, was 511 ft long (411 ft on tangent and 100 ft on an easement curve), was lined throughout with timber portals, and was of restrictive clearance. This tunnel was eliminated by a line change 0.3 mile in length on improved alinement, put in service in 1943. The change required the grading of about 115,300 cu yd of material. While this work was being carried out, the grading organization was augmented by the addition of two 18-cu yd carryalls, each drawn by a 95-hp tractor, and the 8-cu yd carryall was assigned to other company work. Thus after these changes, the principal units of the organization consisted of the two original 12-cu yd carryalls, the two new 18-cu yd carryalls (all drawn by 95-hp tractors), and the two original bulldozer outfits, one a 95-hp tractor and the other a 54-hp machine.

After completion of the line change at tunnel No. 20, the grading outfit was sent to the site of tunnel No. 17½ (at milepost 434.8) between Russ and Lang stations. Constructed in 1886, this tunnel was 187 ft long, all on a 10° 00′ curve. It was timber lined throughout, and of restricted clearance. Elimination was accomplished by an open-cut line change 0.4 mile in length with improved alinement, which required the moving of about 32,400 cu yd of material. Before assignment to this line change, the grading outfit was further augmented by a 24-cu yd carryall drawn by a 95-hp tractor.

Another line change, to eliminate tunnels Nos. 21 and 22, was placed in service December 19, 1944, on the San Joaquin Valley line. Tunnel No. 21 (at milepost 440.1) was 317 ft long, and tunnel No. 22 (at milepost 441.5) was 331 ft long. Both were constructed in 1890, on alinements varying from tangent to and including 10° 00′ curves; both were timber lined throughout, with timber portals; and both were of restricted cross section.

The line change to eliminate these tunnels is 2.23 miles long. In addition to eliminating the tunnels, it improves the alinement and grade of the railroad by shortening the line 0.07 mile, reducing the degree of the maximum curve from 10° to 4°, reducing the curvature from 458° to 281°, a saving of 177°, and reducing the maximum grade rate from 2.27% to 1.12%, a reduction of 1.15%, which also made the grade line more uniform. This line change involved the moving of 284,457 cu yd of material. Except for one rented tractor, a 95-hp machine used on this work, all the grading equipment used on this work was company owned. It comprised 2 rooters, 5 carryalls, 5 tractors, 3 tractor-bulldozers, and 1 tamping roller, the latter used for compacting embankments.

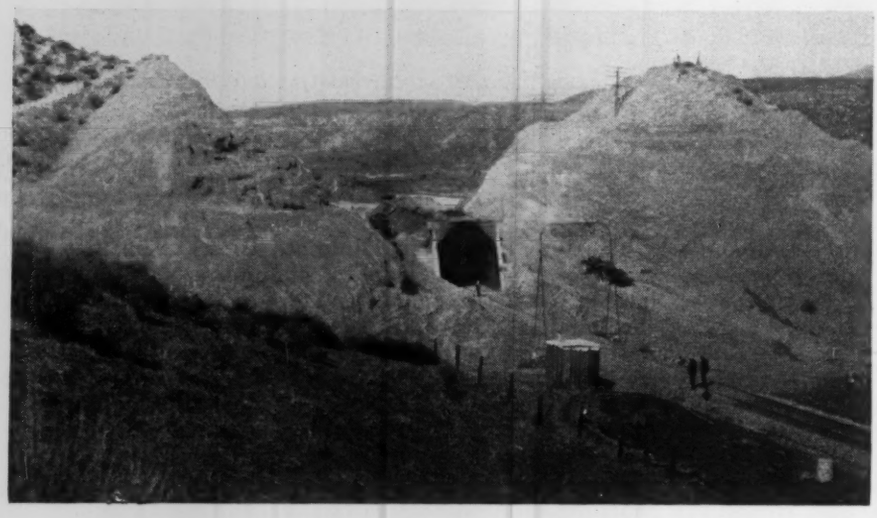
It is recognized that the grading organization used on a number of the tunnel-elimination jobs was somewhat out of balance in that it did not include a sufficient number of heavy tractors for operating the rooter and for pushing the carryalls when loading. In fact, at times it was necessary to do the rooting at night in order to release the 95-hp tractor during the day for pusher service. However, on account of wartime limitations on the sale of crawler equipment, it was not possible to acquire all the necessary equipment for a well-balanced organization. It was considered desirable, therefore, to have two additional 95-hp tractors, one of which would be used to replace the 54-hp tractor in order that, in the event of failure of a tractor hauling a carryall, a substitute machine of sufficient capacity would be available. One additional 95-hp tractor has already been acquired, but it has not yet been possible to obtain one to replace the 54-hp tractor on this work. (The 54-hp tractor is ideally suited for maintenance work, restoring of embankments, cleaning of cuts, clearing of fire guards, and such.)

A WELL-EQUIPPED AND VERSATILE ORGANIZATION

The principal units of the Southern Pacific Company's grading organization now include 5 carryalls (one 24-cu yd, two 18-cu yd, and two 12-cu yd), all drawn by 95-hp tractors; and three bulldozer outfits, including

one 54-hp and two 95-hp tractors, of which the former is eventually to be replaced by a 95-hp machine. Other units of equipment include two rooters; a tamping roller (sheepsfoot); a 315-cu ft, wheel-mounted air compressor; a wagon drill; a gasoline-engine-driven, 4-in.-diameter centrifugal pump; and a sprinkling unit, consisting of a tank mounted on a motor truck. The outfit is a well-equipped, completely integrated organization capable of performing grading work in an efficient and economical manner. The methods used are in accordance with best current practices. For instance, in the construction of embankments the material is deposited and compacted in layers 6 to 8 in. in thickness. If too dry for proper compaction, the material is moistened in the excavations, using temporary pipe lines and hoses equipped with nozzles for sprinkling.

While this grading organization has been described principally in connection with the tunnel-elimination work, the intention of the railroad is, and has been, to use it on any type of work for which it is suitable and available. In fact, during intervals between tunnel jobs, the organization, either in whole or in part, has been used for various other types of work, such as the removal of slide material from the railroad roadway, repair of damage caused to the roadbed by flood-water conditions, grading for industrial tracks, and grading in connection with siding extensions and line-change projects.



TRAFFIC WAS MAINTAINED THROUGH TUNNEL 23 DURING "DAYLIGHTING"

LATEST LINE CHANGE COMPLETED

On October 12, the organization completed the construction of a line change about 0.9 mile long, on the railroad's Coast line between San Francisco and Los Angeles, Calif., at what is known as the Honda Notches (milepost 307), where the railroad skirts the shore line of the Pacific Ocean. Since the embankment at this point is subject to constant erosion from wave action, a line change was decided on to place the center line of the roadbed a maximum distance of 100 ft further into the hillside; this involved the moving of an estimated 508,000 cu yd of grading material. Following completion of this work, the equipment was moved to the Portland Division and put to work filling in a trestle at Whiteson.

The amount of such grading work to be done in the future is expected to be such that there will be no difficulty in keeping this type of organization busy at all times. It was the prospect that there would be a large amount of grading over a period of years, coupled with the conviction that this type of work could be accomplished most economically and expeditiously with company forces and equipment, which led to the decision to develop the grading organization.

On a recent typical grading job, the organization was composed of 13 men. Of these, one was an assistant (civil) engineer, who was assigned to the work as the man in charge; 8 ware tractor operators, one of whom functioned as the foreman; two were additional operators, whose function will be described later; and two were mechanics (one a welder), who made any necessary repairs to the equipment.

The practice is to work the grading organization 10 hours daily, starting at 7 a.m. However, the two extra operators do not start work until 10 a.m., and from then until noon are engaged on miscellaneous work and odd jobs such as handling supplies or helping with repairs. During the noon hour these men take over two of the carryalls and operate them until the regular operators return from lunch. At quitting time in the afternoon the regular operators leave their machines, with the engines running, wherever they happen to be. The two extra operators, who remain on the job until 8 p.m., bring the machines to the central point, where they fuel and service them, and in general prepare them for the next day's work. To expedite the making of any repairs that may require new parts, the railroad's purchasing department has issued a standing order with the nearest agency handling such parts. When the grading organization is to be moved to a new location, the required number of flat cars is ordered and the equipment is loaded on them.

For grading jobs where the use of dump trucks is required, such as where the material to be handled consists largely of rock or where a considerable haul is involved, this company maintains a fleet of 32 dump trucks, ranging from $2\frac{1}{2}$ to 10 cu yd in capacity. As has been mentioned, the grading work at tunnel No. 0, on the main line of the Sacramento Division, was carried out by company forces using its dump trucks as the hauling medium. The organization on this job included two $1\frac{1}{4}$-cu yd steam-driven crawler shovels, six $4\frac{1}{2}$-cu yd dump trucks, a tractor-bulldozer for keeping the access road in proper condition and for spreading the material dumped from the trucks, and a compressor for supplying air for drilling, which was performed with jackhammers.

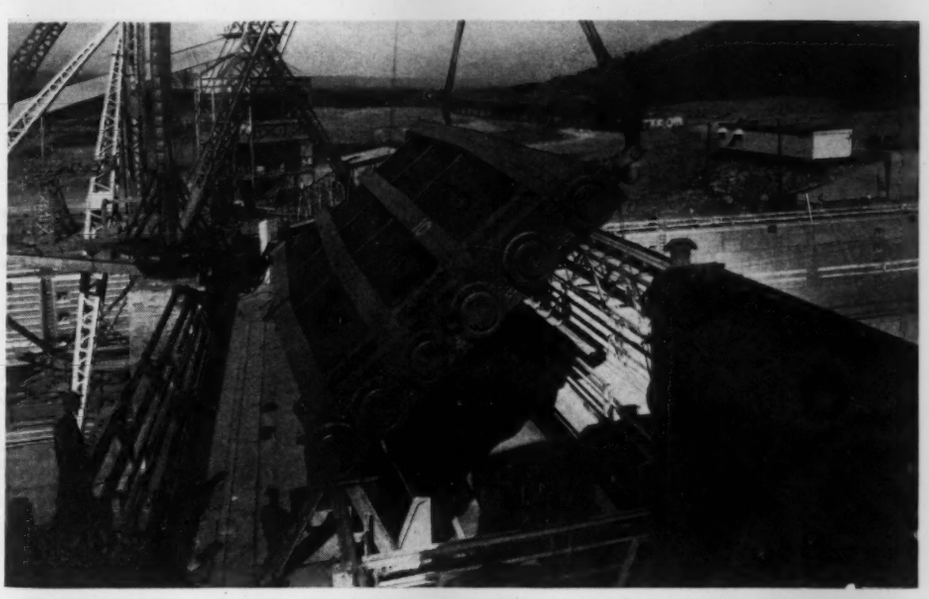
The organization that worked on the grading of the Honda Notches line change was considerably augmented over other recent jobs by the addition of more men and more and other suitable equipment on account of the large yardage to be handled.

Tunnel-elimination work and development of the grading organization was initiated under the general supervision of the late W. H. Kirkbride, M. ASCE, then chief engineer of the Southern Pacific Company, and has been continued and further developed under the direction of his successor, E. E. Mayo. R. B. Chapman, supervisor of work, equipment, and welding, has direct supervision of the acquisition, assignment, personnel operation, and repairs to the equipment.

Spillway Gates and Equipment on TVA Projects

By KENNETH C. ROBERTS, M. ASCE
HEAD STRUCTURAL DESIGN ENGINEER, TENNESSEE VALLEY AUTHORITY, KNOXVILLE, TENN.

IN all designs of the Tennessee Valley Authority, economies have been sought through standardization. Special opportunities for duplication were offered by spillway control devices. But two types of gates were used, radial and vertical lift, and sizes were determined so that complete units could be interchanged in many installations. In his review, Mr. Roberts has taken advantage of the fact that these hydraulic structures have been in operation long enough to permit collection of revealing records.



EQUIPMENT FOR UNLOADING GATES FOR CHICKAMAUGA DAM FROM BARGES
Gate Upended for Placement in Gate Slots

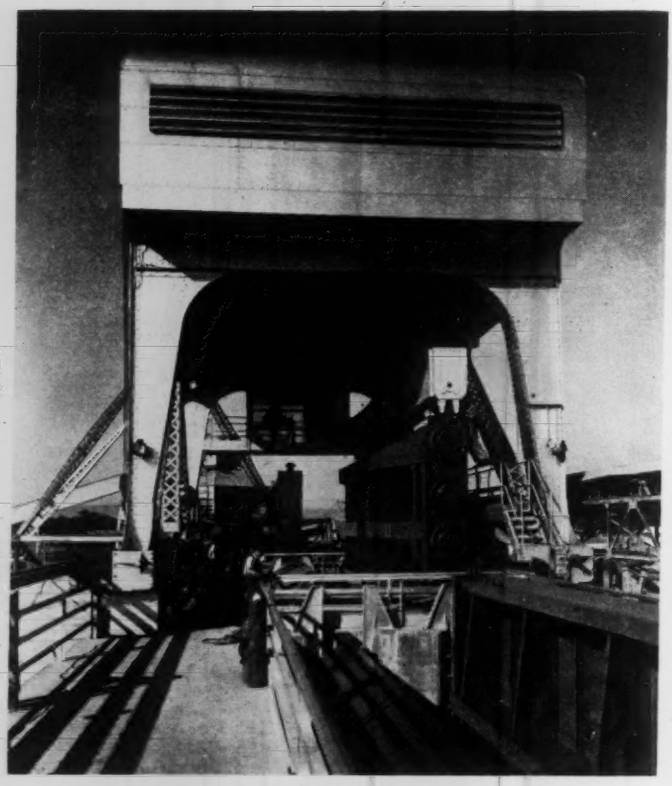
DESIGN of gates for controlling the discharge of water through the system of dams of the Tennessee Valley Authority is governed by the functions required in the multi-purpose operation of its projects for navigation, flood control, and power generation. Here the existence of a comprehensive plan for the development of the Tennessee River and its tributaries offered an opportunity for a review of the conditions that affect the design of control equipment.

It soon became evident that both natural conditions and the conditions to be expected under the contemplated development program were highly favorable. With the areas of the continuous series of reservoirs cleared, with the shore lines under the control of the Authority, and with ice flows a rather remote possibility, wide, unobstructed openings were deemed unnecessary. The river waters are in general free of pollution conducive to corrosion. With the large reservoirs, water levels may be maintained without a fine degree of regulation of discharge, and under the system of forecasting and routing river flows practiced, warning of necessary changes in discharge rates is given in ample time for these changes to be made with slow-speed equipment. Consequently it became possible to design to the fundamental hydraulic and structural requirements. Strength, simplicity, and economy were considered primary objectives.

The policy of duplicating equipment wherever possible without significant loss of economy and functional efficiency was adopted at an early stage in the program. As a result, the spillway gates at Pickwick, Guntersville, and Chickamauga dams are of the same basic design as those at Watts Bar, Fort Loudoun, Cherokee, and Douglas, as well as those at Hiwassee, Apalachia, and Ocoee No. 3. In other groups, intake gates and sluice gates are duplicates. This policy proved especially helpful in obtaining equipment during the emergency, and permitted the transfer of equipment in cases of necessity.

Basic hydraulic data for spillway-gate design include, among others, the maximum design flood and the relationship between headwater and tailwater for all conditions of flow. The allocation of reservoir space establishes the conditions of maximum discharge. From these data, together with a consideration of natural stream-bed conditions, and the space requirements of the lock, power house, and other elements of the project, it is possible to establish the elevation of the gate sill and the overall length of the spillway. The elevation of top of gates is fixed at maximum operating reservoir level, without allowance for freeboard, since the water is seldom maintained at this level for protracted periods. For the main-river plants and those on the larger tributaries, this has led to the use of gates that vary in height from 32 to 50 ft.

With the height of gates determined, the next important step is the choice of type, in which are involved considerations of economy, structural practicality, and functional arrangement, not only of the gate structure, but of the complete spillway structure. Comparative studies of the various generally recognized types of gates were made, attention ultimately centering on a choice between vertical lift and Tainter gates. Under conditions of discharge permitting a normal positioning of the gate trunnions, Tainter gates were found to have an advantage in economy and in simplicity of construction over the vertical lift type. On several of the main-river projects, however, where the maximum pool level is somewhat above the top of the gates, and where the difference between headwater and tailwater under maximum flood flows is small, the Tainter gate arrangement becomes awkward, since the trunnions are located above the discharge nappe and adjustments in operating equipment and deck must be made to provide the necessary clearances. Under these conditions, comparison favors the



SPILLWAY GATE-HANDLING EQUIPMENT ON CHICKAMAUGA DAM

lift type of gate. Accordingly, Tainter gates have been installed at dams where conditions were found suitable, and vertical lift gates at the remaining dams.

A cost comparison further indicated that, for gates of the required heights, maximum economy is realized when the gate width approximately equals the gate height. Also, with these proportions, the loads imposed on the operating elements of the gates and on the operating equipment are not excessive and permit design with the use of readily available commercial parts.

Much thought was given to the use of welding, since its advantage in watertight construction is obvious. Comparative designs for welded and riveted fabrication were prepared, and as expected, the welded design showed a saving in weight, although a corresponding saving in cost was not confirmed. At the time, several years ago, when these gates were designed and purchased, there was a belief that the industry as a whole was not quite ready for a radical departure from established methods of fabrication. Consequently, a riveted construction appeared to be the more suitable choice. The advantages of a continuous skin plate in preventing leakage, and in eliminating the areas—such as at rivets—that are vulnerable to corrosive attack, appeared so great that it was decided to combine the two forms of construction in a design consisting of a riveted frame, to which the skin plates were attached by welding. The combination has proved wholly satisfactory in this instance. It is realized, of course, that over the last few years great advances in the art of welding have been made under the stimulus of wartime demands, and that welding methods will undoubtedly find greater use in this type of structure in the future.

Vertical lift gates have been installed at Kentucky, Pickwick, Guntersville, and Chickamauga dams, all of which are main-river projects. Those at Kentucky Dam have a nominal height of 50 ft and a clear opening of 40 ft. Those at the other three dams are substantially duplicates of those originally designed for Pickwick Dam (Fig. 1); they have a nominal height of 40 ft and a clear opening of 40 ft.

A gate of these proportions creates problems of erection and alinement at the job site since it is impossible to obtain shipment of the completely assembled unit by ordinary means. For such a gate, good practice requires shop assembly of the complete gate after fabrication, dismantling for shipment, and erection and alinement of wheels in the field. With the number of gates required for each dam varying from 18 at Chickamauga to 24 at Kentucky, it may be readily understood that this field erection could be an operation of considerable magnitude. An additional and important consideration is the relatively high capacity and physical proportions of the gate-handling equipment.

To meet these objections, the gates are subdivided into sections not exceeding 20 ft in height. Each section is a self-contained unit complete with accessories, without couplings of any kind to its matching section, and is handled as a separate unit at all times. These sections were completely assembled in the shop and were shipped, by barge, ready for immediate installation in the gate slots. The only field work on the gates was the painting.

Discharge of water at moderate flows occurs through openings between the top and bottom sections of the gates. An important consideration with this type of discharge is the provision of adequate means of venting the space below the nappe at the downstream face of the bottom gate section in order to prevent subnormal pressures and the consequent overloading of the gate. For discharges greater than can be accommodated by the removal of the top sections, bottom sections in sufficient number are raised above the nappe.

The gates are supported and run on tracks located in slots in the piers. Two sets of identical slots are provided—the downstream or service slots in which the gates normally function, and the upstream or emergency slots in which a spare gate may be operated to effect a closure for maintenance purposes or for the repair of damage in case of an accident to the service gate in the downstream slot. Gates are stored, with clearance over the discharge nappe, in the slots at deck level when not in use. All gates are interchangeable and may be used in any slot, either upstream or downstream.

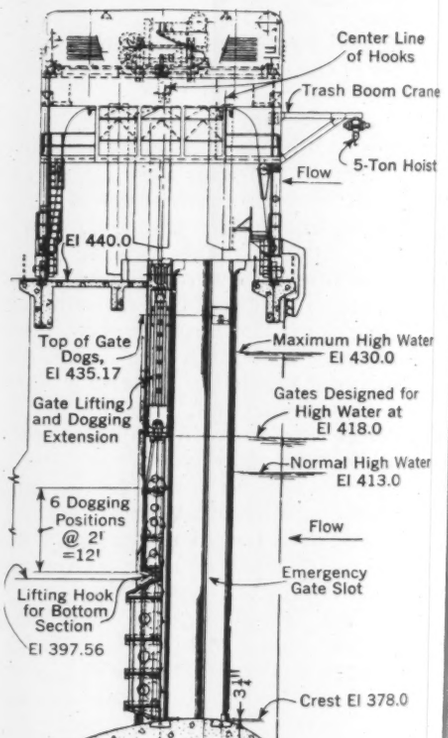
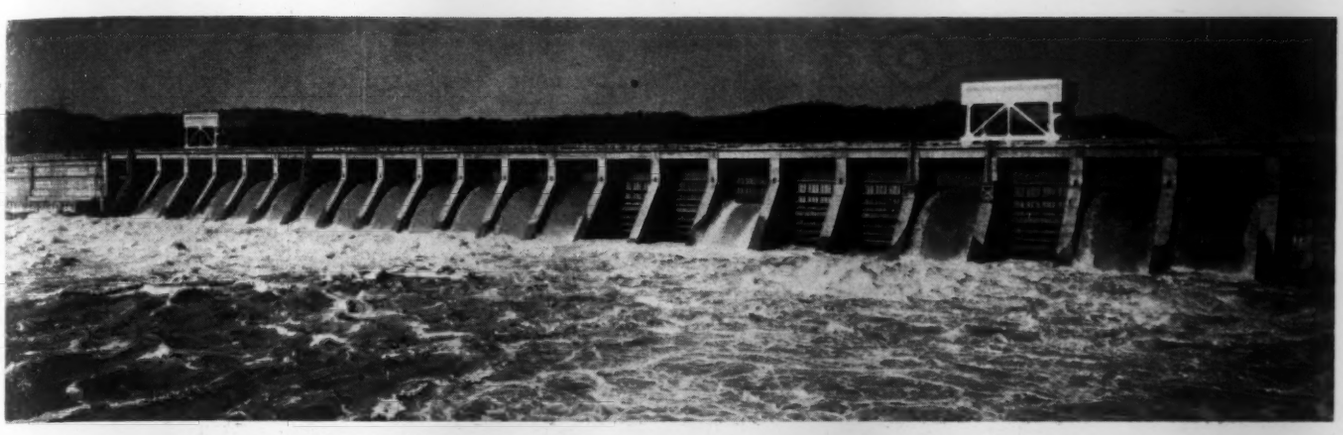


FIG. 1. SECTION THROUGH VERTICAL LIFT GATE AT PICKWICK LANDING DAM



DISCHARGE FOR PARTIAL AND FULL OPENING OF TOP GATE SECTIONS—PICKWICK DAM

No single element of the gate is of more importance to successful operation than the wheels. Of the two common types, the one bronze-bushed and the other mounted on anti-friction bearings, the former is somewhat less expensive, and considerations of economy dictate its use where its relatively high frictional resistance permits. Generally the wheels are mounted on axles cantilevered from the gate body. This mounting eliminates all machining on the gate body except the boring of the axle holes, and permits the use of relatively small and shallow gate slots, avoiding excessive weakening of the piers. The wheels also serve as the guiding element in the slots, and as support brackets when the gate is dogged in any of its raised positions.

Radial gates have been installed at a group of projects including Hiwassee, Apalachia, and Ocoee No. 3 dams, and at a second group comprising Watts Bar, Fort Loudoun, Cherokee, and Douglas dams. Those in the first group are 23 ft high by 32 ft wide; those in the second group are 32 ft high and 40 ft wide. Within these

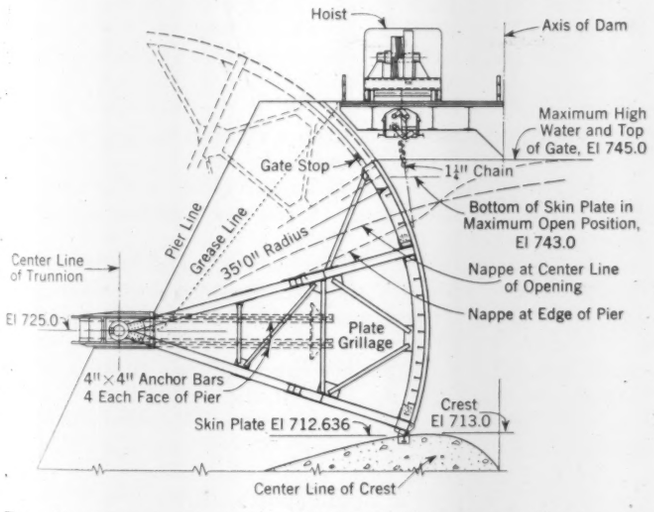


FIG. 2. RADIAL GATE AT WATTS BAR PROJECT, RAISED BY TRAVELING HOIST

groups the gates for all projects are identical. A third design, with provisions to accommodate discharge over the top of the gate, is planned for Fontana Dam.

The practice of shipping gates fully assembled in the shop, previously followed and found advantageous at other main-river projects, was substantially repeated at Watts Bar Dam. The blade of the gate (Fig. 2), including skin plate and supporting beams, the transverse trusses and bracing, and accessories such as guide wheels and seals, was shipped by barge completely assembled and painted. The rocker arms, with bearings assembled, were shipped separately. At other dams, however, the only practicable access was by rail, and consequently the gates were shipped knocked down into subassemblies as few and as large as possible.

The gates conform to conventional design in respect to structure, seals, and accessories. Gate anchorages for the several groups differ greatly because of the variation in loading. Those generally used with gates of the first group consist of a through trunnion supported in a plate cylinder embedded in the pier, which is reinforced to resist the gate thrust. Those for gates of the other groups are weldments of heavy plate-and-bar sections, which project beyond the pier and support the trunnion bearings. For better distribution of shearing stresses over the pier, the anchorage bars are wrapped to prevent bond with the concrete and to deliver their load to a grillage located a sufficient distance upstream to insure low stresses within the pier.

CRANES AND HOISTS

Handling methods and equipment for the gates become an essential and integral consideration in establishing the main features of a dam. In general, the equipment is of the mobile type, traveling on a track on the operating deck of the dam, and is usually installed in duplicate, not only to provide adequate handling facilities for periods of great activity, but also to insure the availability of at least one unit in serviceable condition at all times.

Separate hoisting units for each gate unit, as occasionally installed elsewhere, were given consideration, but since the number of gates comprising the spillway of most of the Authority's projects varies up to 24 in number, the economic comparison favors the mobile equipment. Furthermore, the adoption of the sectional gate design for those projects equipped with vertical lift gates practically precludes the use of fixed hoists. Another factor influencing this choice was the possibility of the use of the same mobile equipment not only for handling spillway gates but also for other services.

The exceptions to the use of this general type of equipment occur at Apalachia, Ocoee No. 3, and Fontana dams. Apalachia and Ocoee No. 3 dams are at considerable distances from their power houses, and separate fixed hoists are installed for each of the radial gates of the spillway to permit the ready application of remote-control features, which in the future will undoubtedly be found desirable. At Fontana Dam there are four radial gates arranged in pairs, each pair operated by a common fixed hoist.

GENERAL VIEW OF FORT LOUDOUN SPILLWAY

The sectionalized vertical lift gates present a rather unique problem in the development of methods and devices for handling the bottom gate sections whose tops are at an elevation approximately 20 ft or more below pool level, and which must be raised and lowered through the discharge jet flowing over the gate section. The equipment chosen for this service comprises two gantry cranes with lifting beams, lifting extensions, and gate dogging devices. The lifting extensions serve two purposes: when attached to the control gates they support the gates in the various regulating positions; and when attached to the lifting beams, they may be lowered through the discharge jet to engage and lift the submerged bottom gate sections. The gate dogs provide a retractable latching seat, engaging either the tread of the gate wheel or the steps of the lifting extensions, for support of the gate in the regulating or storage position.

The design of load brakes received much consideration. Brakes combining certain features of mechanical and regenerative electrical braking were adopted.

Kentucky Dam, about 20 miles above the confluence of the Tennessee and Ohio rivers, is the latest and largest of the main-river developments. In its design the practices previously developed were carried over in so far as possible, but the increased scale of the work demanded independent consideration of many basic features. The sectionalized gate design was continued with the important differences that the overall height of gate was increased from 40 to 50 ft, and the gates were subdivided into three sections rather than two. These changes increased the depth of the discharge jet, through which the bottom gate sections must be raised and lowered, from 20 ft to 31 ft 6 in. Gate-lifting loads also increased because, primarily, of the increased frictional resistances of the additional water load on the gates. Furthermore, the need for close control of regulation of flow and its distribution became of distinctly secondary importance, since the relatively great depth of tailwater in conjunction with the design of the apron removes the danger of serious erosion.

When developing preliminary layouts and designs, it soon became evident that the handling of submerged gate sections by the system of lifting extensions was not particularly adaptable in all respects, in part because of the necessary increases in the length of extensions and in the proportions of the gantry cranes to provide clearances, and in part because of complications in handling two gate sections (the middle and bottom), instead of one, under water—since both may be submerged under certain schedules of reservoir operation. An alternative arrangement, employing two independent lifting blocks traveling in the gate slots and handling all gate sections directly, whether submerged or not, which had been studied and developed over a period of several years, was adopted. It has the advantages of direct application, without the use of accessory equipment, to the handling of all gate sections, of speeding up gate operation, and of reducing clearance requirements for the cranes. The result is a simplified procedure of gate handling.

The gantry-travel drive represents a departure from previous practice in the design of gantry cranes for gate-handling purposes, but follows the practice previously developed in the design of cranes and gantries for power-house service. In this arrangement four separate driving units are mounted on the gantry trucks, one at each corner of the crane, replacing the cumbersome and troublesome system of shafting and gearing with the common overhead motor drive. The four standard, wound-rotor-type motors are controlled from a single master switch; either the forward or rear pair of motors may be disconnected as a pair but not individually.

No provision is made, either in the arrangement of controls or by means of special equipment, for synchronizing the speeds of the two motors of each pair. The commonly raised objections that differences in motor characteristics and loadings result in unequal motor speeds, with consequent wear and binding on the track, were of course considered, but the conclusion was reached that there was adequate stiffness in the gantry structure to permit the transfer of load without significant deflections between the driving units, with a resulting equalizing effect on motor speeds. Operating experience bears out the soundness of this reasoning.

RADIAL GATES SIMPLER TO OPERATE

In comparison with the handling equipment for the sectional vertical lift gates, that for the radial gates of Watts Bar Dam and others of the group is relatively simple with respect to both type of equipment and operating procedures. The gates are suspended at all times—except when resting on the sill in the fully closed position—on the hoist chains from a chain deflector and dogging unit recessed into the spillway deck; they are raised or lowered by means of a hoist traveling on the spillway deck, to which the lifting chains are coupled manually whenever necessary.

The hoist chains are forge-welded, Die-Lock anchor chains of alloy steel. This chain was developed and is in extensive use by the United States Navy. It is manufactured to fairly close tolerances in a stud-link form which practically eliminates the tendency to kink when stored, but with the stud cut at the center to avoid the increased bending stresses inherent in the solid stud-link form.

The traveling gate hoist comprises two grooved chain drums driven from a single motor through worm-and-spur gearing, the whole mounted on a four-wheel truck. Since close speed control is not necessary, the hoist motors are of the squirrel-cage type. Lowering control is provided by the regenerative braking action of the motor. The fixed hoists installed at Apalachia and Ocoee No. 3 dams are somewhat similar in design, differing mainly in the omission of the truck and in the use of pocketed chain sprockets instead of grooved chain drums. Also, since remote control of these hoists is contemplated, slack chain switches are provided to prevent overtravel of the hoist in the lowering direction if the motion of the gate should be obstructed.

Improvements to Water Works at Mobile, Ala.

By ARTHUR N. BECK, M. ASCE

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IN the city of Mobile, Ala., the hazard of delivering a surface water with no treatment other than chlorination has now been removed by the construction of a 20-mgd filtration plant. The two sources of supply, both before recent improvements and at the present time, are Clear Creek and Three Mile Creek, both of which have small impounding reservoirs. Only a relatively small portion of the watersheds of these streams is owned and controlled by the city.

When the original public water supply for Mobile was developed from these two streams, very few people lived on, or contributed pollution to, the watersheds. However, as the city grew in industrial importance, so did inhabitation on the watersheds. In 1935 a survey, made by personnel of the Mobile County Health Department, indicated that even then there were 130 houses on the watersheds, some served by insanitary facilities. In order to minimize pollution, 57 sanitary privies were built at the expense of the city. In 1939 another survey listed 152 houses on the watersheds; and the 1941 survey reported 288 houses, or 136 new homes built from 1939 to 1941. A hundred and forty-seven, or 51%, of these were provided with improper sanitary facilities. (This condition was later corrected.) In addition to the houses, there were 18 dairies, with a total of 550 cows, on the drainage area.

The inhabitaton contributing pollution to the Mobile water supply, together with the growing demands on the water works caused by the influx of population, caused great concern. The demand rose from an average of approximately 6 mgd in 1937 to 9.0 mgd in 1941, and to an ultimate of $17\frac{1}{2}$ mgd before the new filtration plant was placed in service. The estimated population increase in the metropolitan area, due principally to war activities, was from 115,000 in 1940 to 225,000 in 1944. Obviously no water could be by-passed, as the pumps were in practically continuous operation.

In the early part of 1942, the purchase of additional chlorinating machines was necessary. Dosages were increased to about $1\frac{1}{2}$ to 2 ppm. In the summer of the same year, it became necessary to again increase the chlorinating capacity in order to feed approximately 6 ppm to the raw water. These dosages were high, but because of the condition of the distribution system itself, it was imperative that every precaution possible be taken to avoid a water-borne epidemic.

This distribution system, owing to the increased demands placed upon it, and to incrustations within the pipes themselves, had become inadequate. It was reported that at certain periods of the day, pressures dropped from a normal of 70 lb to 40 lb in the business district. The 24-in. pipe line from the Bienville Reservoir, which was installed in 1888, was so tuberculated that the coefficient of friction had dropped to a value of about 60. Conditions became so bad that people in certain areas were unable to secure water at all, particularly during certain periods of the day. Negative pressure was a constant concern, particularly since no chlorine residuals could be obtained over the distribution system.

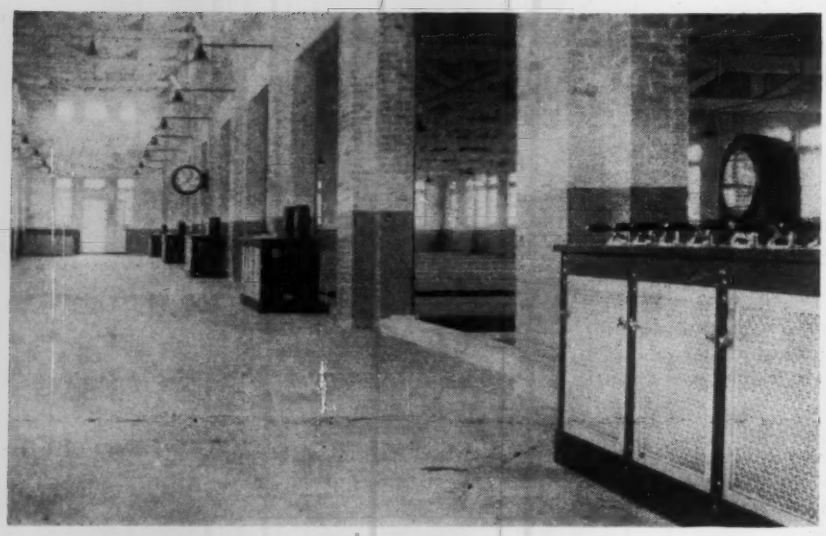
EXTENSIVE PROJECT AUTHORIZED

Realizing the seriousness of the situation, officials of the city appealed to federal agencies for the financial aid made available by the Lanham Act. The Mobile water works project was one of the first in the country to be submitted. After considerable discussion between the FWA and WPB, the improvements in their entirety were approved as a federal project. A 20-mgd filtration plant, a raw-water reservoir, a new distribution main, and feeder lines were built at a cost of about $2,250,000.

The surface waters in or near Mobile are soft, low in pH value and alkalinity, and relatively high in organic color. Much time and thought were given to the design with respect to treatment facilities in order to secure flexibility of operation, especially as regards the use of various coagulants and flows through the settling basins.

Raw water from all three present sources of supply (Three Mile, Clear, and Eight Mile creeks) enters the raw-water reservoir through the respective lines. This reservoir has a capacity of 20 million gal, which corresponds to the daily capacity of the filter plant. It is near the filter plant, and has rolled earth embankments. Its bottom dimensions are 325 by 325 ft, with side slopes

MAIN BUILDING OF THE NEW MOBILE, ALA., WATER WORKS
Building at Right Is the Primary Chemical House



INTERIOR OF FILTER BUILDING ON OPERATING FLOOR

of 1 on 2 and a depth of 21 ft. The entire bottom and slopes are lined with 3-in. Gunite, reinforced with 4 by 4-in., No. 4 wire mesh. The top of the embankment is paved with ordinary concrete, and there is a curb 12 in. high at its outer edge to prevent overflow. An overflow flume and drain are provided.

From the raw-water reservoir a 30-in. cast-iron line connects with the low-lift pumping station, which pumps the water into the filter plant through two 24-in. cast-iron lines. This station is equipped with two 7,000-gpm pumps and one 14,000-gpm pump.

From the low-lift station, water passes through a venturi-type meter equipped with an indicator and recording mechanism. Adjacent to the venturi, and ahead of the rapid-mix basins, is a 24-in. hydraulically operated water-level regulator. The two rapid mixing basins are 12 ft 6 in. by 12 ft 6 in. by 12 ft 3 in., operated in series. They are equipped with impeller-type mechanical mixers manufactured by Infilco. Coagulants are fed into the basins at the point of entry of the raw water by Infilco dry-feed machines. Two Wallace and Tiernan chlorinators are provided for prechlorination. Chemicals are unloaded on the chemical-house platform. Coagulants are lifted by a Globe Hoist elevator to the second story, where they are stored or discharged to the chemical-feed hoppers. Mixing and retention chambers, which may be used in conjunction with iron salts, are provided in the chemical house.

From the rapid mixers the water passes into four primary coagulating basins operating in parallel. Each of these is 14 ft by 56 ft by 12 ft 3 in. deep, and equipped with Infilco paddle-type coagulators. The retention time, based on the design flow, is approximately 20 min.

The coagulated water is delivered to the settling basins by an intricate system of flumes so gated that the basins may be used in parallel or series, singularly or in pairs, allowing the maximum in flexibility. All coagulated water must pass through a stilling wall upon entering each basin. The stilling wall is constructed of concrete with four rows of holes 5 in. in diameter, on 2-ft centers. The take-offs are through horizontal 8-in. slots 20 in. below the water level. These 8-in. horizontal slots extend across the full width of the basins.

The four settiing basins are each 70 ft 9 in. by 196 ft 6 in. and 12 ft 3 in. deep. They have a combined capacity of about 5,000,000 gal. No baffles are provided. The detention period is slightly in excess of 6 hours.

Secondary coagulating facilities were installed at the end of the settling basins, opposite the primary coagulators. These facilities consist of two mixing basins equipped with Infilco paddle-type coagulators, and a chemical house which has ample storage space and is equipped with Infilco dry-feed machines.

Filters are of the rapid sand type, constructed adjacent to the side of one of the settling basins and separated from the basin wall by the filter influent flume. Each of the ten individual filter beds has a capacity of 2.0 mgd, and each bay, waste, and influent valve is common to two filter units. The filter underdrains are of the Wheeler type with a false bottom 24 in. in depth. Graded gravel 12 in. deep supports 30 in. of sand. The surface of the sand is 24 in. below the lips of the concrete wash-water troughs.

Each filter unit is equipped with simplex rate controllers, indicating loss-of-head gages, flow gages, and hydraulic valves. The loss-of-head and flow gages, together with the hydraulic controls, are located on operating tables situated on the operating floor. One table is provided for each two filter units. The installation of the filter bottoms, filter media, and appurtenances was done under contract by the Roberts Filter Manufacturing Company of Darby, Pa.

The filter water is delivered to a 1,000,000-gal concrete clear-water reservoir through a concrete conduit 10 ft 3 in. by 3 ft 6 in. A tile sight-well on the conduit is situated in the lobby of the plant building. Wash water is taken from the clear-water reservoir by a 10,500-gpm Pomona turbine-type pump and delivered to the filter false bottom through a 24-in. cast-iron wash-water line. The waste water is discharged to an open concrete flume connecting to a 27-in. concrete drain. A 24-in.-diameter indicating gage, manufactured by Simplex Valve and Meter Company, is located on a column midway of the operating floor for the purpose of making it possible to observe the quantity of wash water being used.

The main plant building houses a chemical room for post-chlorination and pH control, laboratory rooms equipped for making bacteriological and chemical analyses, a wash-water pump room, shop and repair space, and wash and rest rooms.

The layout is such that additional settling basins and filter units may be installed on the opposite side of the plant building in units up to a total of 40 mgd.

As stated previously, the surface waters in the Mobile area are relatively high in organic color at times. The Chickasaw plant, downstream from the present Mobile plant on Eight Mile Creek, has been in operation a number of years serving part of the Mobile metropolitan area. Many experiments have been conducted at this plant by a number of engineers and chemists representing various concerns. At the time the Mobile plant was designed, the Chickasaw plant was using chlorinated copper as the primary coagulant. Lime was added by means of dry-feed chemical machines and mixed with the water in a secondary mixer, placed midway of the settling basin. The secondary coagulation with lime was for the purpose of preventing the recurrence of color in the finished water, and for corrosion control. In order to make the plant as flexible as possible and to provide for the use of iron salts, secondary coagulating facilities were incorporated in the design of the Mobile plant.

PRIMARY CHEMICAL HOUSE WITH FLASH MIXING CHAMBER, FLOCCULATING BASINS, AND SETTLING BASINS
Clear-Water Reservoir in Background Was Part of Old Bienville System

Before this plant was placed in service, many experiments were made using alum and lime as coagulants. The results obtained in the laboratory indicated that these chemicals could be used satisfactorily. Inasmuch as alum and lime are cheaper, easier to handle, and cleaner than iron salts, it was decided to start the plant with these coagulants. The plant has been operating for slightly more than a year and has produced an excellent quality of water.

TREATMENT GIVES GOOD RESULTS

The normal doses for floc formation are approximately 20 ppm of alum and 10 ppm of lime. A dense floc is formed, which settles rapidly in the settling basin. The water in the clear-water reservoir is held to a pH value of about 8.0 for corrosion control. So far no settling or recurrence of color has been caused by this use of hydrated lime. Chlorine is added to the filtered water to maintain a satisfactory residual in the water delivered to the system. It has not become necessary to practice pre- or super-chlorination at the filtration plant.

By means of a 30-in. reinforced-concrete "lock-joint" pipe, the 1.0-million gal clear-water reservoir is connected to the two 10.0-million gal pressure reservoirs. All these reservoirs are at about the same elevation, and the water is delivered to the distribution system by gravity. The high elevation of the water in the reservoirs is about 220 ft, while the downtown area of Mobile is about 12 ft. The datum plane is mean Gulf level.

As two individual supplies formerly served Mobile, practically two separate distribution systems were in use. The Bienville Reservoir was connected to its system by means of a 24-in. cast-iron main, and the Springhill Reservoir to its system by a 30-in. line. These two mains were interconnected at only one point, even though the systems crossed in downtown areas. In an effort to secure relief from low pressure as quickly as possible, the 24-in. Bienville main was cleaned.

In determining the proper corrective means to be taken, the maximum demand assumed was 111 gal per day per capita. The Hardy Cross method was employed in ascertaining the distribution of flow in the larger mains. With these computations, and on the assumption that the larger mains of the two systems be cross-connected, it was determined that a new 24-in. cast-iron main, starting at the filtration plant and terminating in the southern part of the city, would best supply the water and equalize pressures. The length of this 24-in. main is eight miles. The computed average pressure in the downtown area was approximately 70 lb at ground level. Pressure readings taken after this installation show that the actual pressures check very closely with the computed ones.

During the construction of the filtration plant, and up to the present time, there has been almost continuous expansion of the distribution system. Approximately 30 miles of distribution lines, varying in size from 6 to 16 in., have been completed or are now under construction.

The entire project, including design and supervision, was under the personal direction of J. B. Converse, M. ASCE, of J. B. Converse and Company, Inc., of Mobile, Ala. E. M. Stickney, M. ASCE, water works superintendent of Mobile, gave valuable suggestions relative to the design. W. A. Brown, of J. B. Converse and Company, Inc., was in charge of the structural design; N. M. Holmes, of architectural features; and Polglaze and Basenberg, engineers of Birmingham, Ala., were associates on hydraulic features of the filtration plant. A. H. Guion was the general contractor, and the Roberts Filter Company was the contractor for filter equipment. The filtration plant and part of the distribution system were constructed as a federal project. O. T. Ray represented the Federal Works Agency as Regional Director.

Through T. H. Milford, Assoc. M. ASCE, Chief Engineer and Director, and the writer, the State Department of Health rendered as much assistance as possible in the development of the project.

Design of Bridges Against Wind

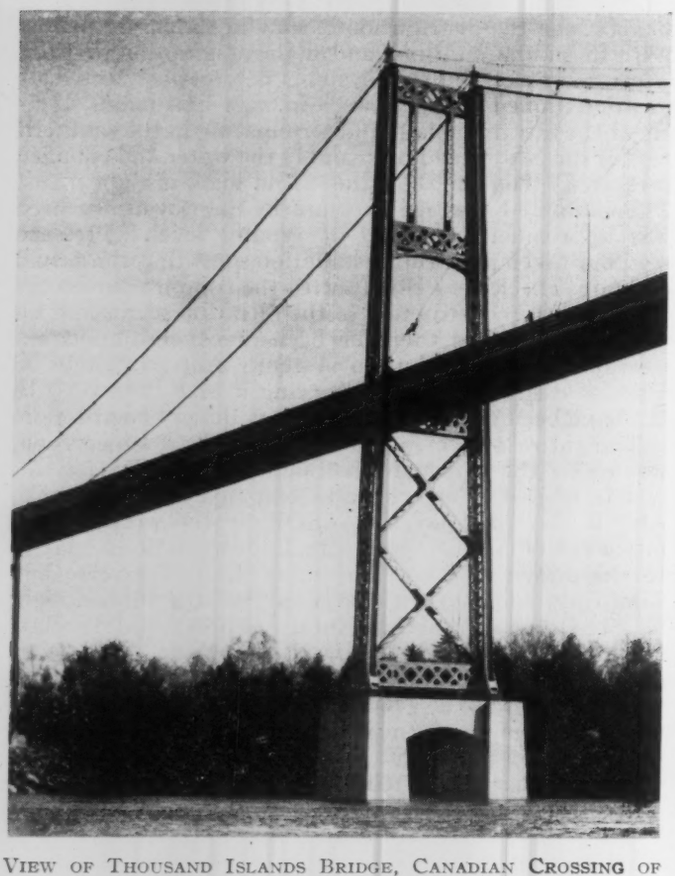
IV. Aerodynamic Instability—Prevention and Cure

By D. B. STEINMAN, M. ASCE
CONSULTING ENGINEER, NEW YORK, N.Y.

HISTORY has shown that the greatest danger to long-span bridges lies in their vulnerability to aerodynamic forces. But because failures had been relatively few for a time, and because the stiffening of suspension spans had been generous, the aerodynamic aspect was forgotten by a generation that preached the virtues of flexibility without recalling its hazards. Recent disasters have shocked engineers into a realization of the dangers. In this installment Dr. Steinman reviews methods of overcoming these great difficulties, based on his investigations and practical application.

THE Tacoma Bridge disaster has awakened the profession to one important lesson: Designers of suspension bridges must henceforth give consideration to the aerodynamic stability of their structures. In 1845 Charles Ellet, applying for the job of spanning Niagara, wrote: "There are no safer bridges than those on the suspension principle if built understandingly, and none more dangerous if constructed with an imperfect knowledge of the principles of their equilibrium." These words summarize an enduring truth; but Ellet did not realize their prophetic nature. Nine years later his proud span over the Ohio at Wheeling wrecked itself by cumulative aerodynamic oscillations.

John A. Roebling, in his writings and in his work, was the first bridge builder to recognize the problem of aerodynamic stability; he built his spans with special provisions to make them safe. But subsequently, for three-quarters of a century, this phase of the bridge engineer's problem completely dropped from sight. We now have to pick up the problem where Roebling left it and, with more mathematics and science than he had available, to carry the solution to maximum completeness and practical applicability. It is of course easy, especially in the shorter spans, to assure aerodynamic safety by generous stiffening, disregarding economy and appearance. The real problem, however, is to assure aerodynamic stability without wasting material on excessive stiffness and without sacrificing artistic proportions.



VIEW OF THOUSAND ISLANDS BRIDGE, CANADIAN CROSSING OF ST. LAWRENCE RIVER
Note Cable Stays on Main Suspended Span

Principal lines of attack for securing or improving aerodynamic stability are the following:

1. To augment the rigidity of the structure
2. To augment the positive damping
3. To modify the cross section

For resistance to aerodynamic effects, the most significant constants of the structure are the coefficient of rigidity K and the stiffening ratio R (the ratio of the contribution of the stiffening elements—trusses, girders, stays, etc.—to the total rigidity). The magnitude of R largely determines the structural damping.

METHODS OF AUGMENTING RIGIDITY

The most obvious method of counteracting aerodynamic instability is by increasing the rigidity of the structure—primarily the rigidity of the main span. Aerodynamic stability increases with the square root of K. Almost any method of increasing rigidity is also directly effective in augmenting structural damping.

Rigidity and structural damping to resist potential aerodynamic instability, both vertical and torsional, may be augmented, in precalculated amounts, by using: (1) deeper stiffening girders or trusses; (2) cable stays, tower stays, center stays, and intermediate stays (Fig. 1); (3) continuous construction; and (4) unloaded ("straight") backstays. In addition, rigidity and structural damping to resist potential torsional instability may be augmented in precalculated amounts by: (5) using transverse diagonal stays (Fig. 2); (6) installing a double—top and bottom—system of lateral bracing; (7) increasing the torsional stiffness of the towers; (8) raising the points of suspender connection relative to the center of gravity of the section; and (9) lowering the center of gravity of the section (for example, by using through construction).

The most direct method of securing adequate rigidity and structural damping is by providing adequate depth of stiffening trusses or girders. Experience to date indicates the hazard of making the truss or girder depth less than $1/100$ of the span. (A more accurate guide is presented in the next article of this series.)

STAYS PROVE EFFECTIVE

In amplitudes attainable, magnitude of kinetic energy accumulated, and structural strains produced, two-segment (single-node, or $n = 2$) torsional oscillations are

generally the most dangerous potential manifestation of aerodynamic instability—as in the cases of the Brighton Chain Pier (1836) and the Tacoma Bridge (1940). A highly effective method of preventing or resisting such two-segment torsional oscillations is to provide adequately proportioned center stays (or other equivalent means of preventing relative longitudinal motion of cable and suspended structure at midspan). The center stays explain why the Tacoma span lasted as long as it did. The dangerous two-segment torsional oscillations were physically prevented as long as the center stays and their connections remained intact. The final failure of the inadequate center stays permitted—not caused—the catastrophic oscillations that wrecked the structure.

LONGITUDINAL STAYS IN PLANES OF CABLES
Illustrated by Side Span of Deer Isle–Sedgwick Bridge, Maine

Another economical method is to use longitudinal diagonal stays, inclined in either direction, in the planes of the cables. Such stays may be located either above or below the roadway, and may have their attachment to points of the cable or to points of the stiffening girder, or to both. Roebling developed and applied this concept in all his suspension bridges. The effectiveness of any stay depends upon the natural difference of displacement, or resistance to equal displacement, of the two points

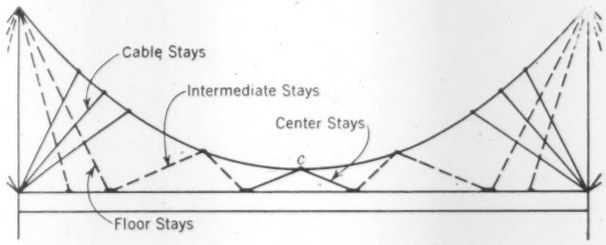


FIG. 1. TYPES OF LONGITUDINAL STAYS TO INCREASE AERODYNAMIC STABILITY

of attachment. Stays running from the tower tops were effective with masonry towers, but are obviously reduced in effectiveness when the towers are flexible. A radiating system of stays is safer than an equivalent single stay, because any single point of attachment may become a node point for some mode of oscillation.

Confirming the writer's analysis and formulas, the few light cable stays originally installed on the Deer Isle Bridge actually increased the coefficient of rigidity K from 63 to 165, and raised the structural damping (δ_s) from 0.013 to 0.053. The critical wind velocity was thereby materially raised. For maximum effectiveness, the two types or directions of longitudinal diagonal stays may be combined to form a double system. In the case of the Tacoma Bridge, such a double system near each end of the span, as calculated by the writer, would have increased K from 62 to 602, at the same time raising the value of R from 0.015 to 0.900. This would have brought the aerodynamic constants of the Tacoma span to safe values.

ALTERNATIVE CONSTRUCTION FOR RIGIDITY AND DAMPING

If the ends of a span were fixed against rotation, the value of K would be increased by 30 to 415%, depending upon the magnitude of R. Similarly, continuous construction, by the restraining condition imposed, serves to augment K, especially in the lower modes (which are also the most dangerous). Simple formulas derived by the writer yield the K values for continuous spans. For the flexible spans of the Tacoma Bridge, continuity would increase K by 24% for $n = 1$, and by 14% for $n = 2$, in which n = number of segments. (The primary mode is $n = 1$.) In more highly stiffened spans (bridges with a higher R value) the percentage increase of K by continuity would be materially larger. Not only is K increased by continuity, but also R (at least in the lower modes). Both K and R are significant for stability. The aerodynamic problem thus adds new importance to the advantages of continuous construction in suspension bridges.

Rigidity and structural damping may be very materially improved by using "straight" (unloaded) backstays, thereby improving both vertical and torsional stability. Computations applied to the proportions of the Tacoma Bridge show that the change from suspended side spans to unloaded backstays can increase K by 87%, R from 0.02 to 0.44, and the structural damping (δ_s) as much as 14-fold; and can reduce the negative damping (δ) by 83%. These improvements in the governing factors would raise critical velocities for the initiation of oscillations by 60%, would reduce the rates of amplification by $^5/_6$ or more, and would reduce the limiting amplitudes by as much as 100%, causing some of the modes to become impossible.

An economical and highly effective method of resisting or preventing torsional oscillations is the use of transverse diagonal stays (Fig. 2) located between opposite suspenders at selected panel points of the span. Transverse horizontal struts or ties between the cables may be used in conjunction with such stays for still greater effectiveness. For the Tacoma span, diagonal stays of only 1 sq in. per panel point would have yielded a more than 50-fold augmentation in torsional resistance, represented by an increase in K from 62 to 3,532—many times more

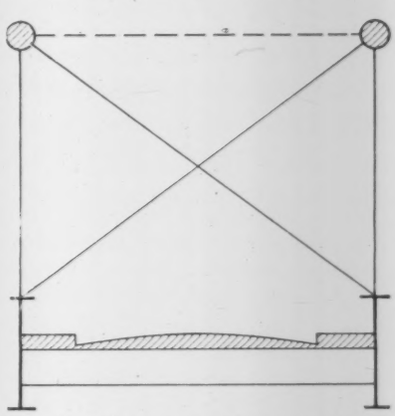
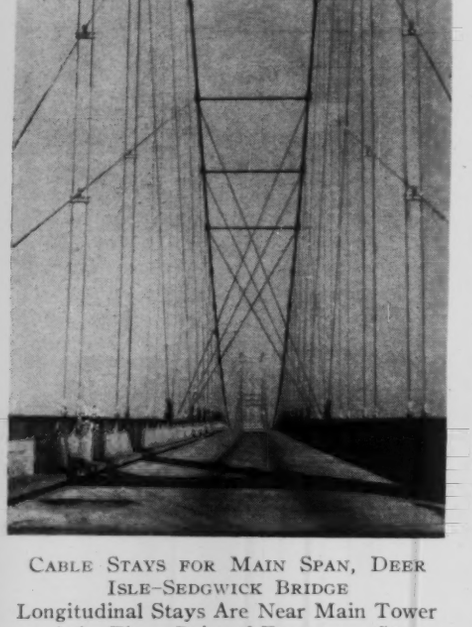


FIG. 2. TRANSVERSE DIAGONAL STAYS TO RESIST TORSIONAL INSTABILITY



CABLE STAYS FOR MAIN SPAN, DEER ISLE–SEDGWICK BRIDGE
Longitudinal Stays Are Near Main Tower and the Three Pairs of Transverse Stays Near the Quarter Point

than sufficient for assured torsional stability. The Deer Isle Bridge has been equipped with such a system as a safety precaution, to preclude any remote possibility of torsional oscillations developing at wind velocities higher than the 80-mile storms thus far experienced.

Another highly effective method of augmenting resistance to torsional oscillations is by providing two planes of lateral bracing, at or near the top and bottom flanges of the stiffening girders, respectively, so as to secure the integral effect of a hollow rectangular section in torsion. The cross-section is assumed rigidly constructed or braced so as to preserve its rectangular form. The resultant transverse shearing forces in the four planes of the tubular member, when it is subjected to torsion, will then contribute very material increases in torsional K and R.

According to the writer's calculations as applied to the Tacoma span, by adding comparatively light systems of top and bottom lateral bracing (5 to 20 sq in. of equivalent horizontal web section), K is increased from 100 to 400%, and R is multiplied 35- to 50-fold (which means a corresponding increase in the structural damping). The higher values of K and R would have prevented the torsional oscillations and the failure of the structure in the 42-mile wind that destroyed it. In fact, they would have assured torsional stability at a wind of 100 miles an hour. If the girder depth were doubled, the numerical increases in K obtainable by adding the wind trusses would be quadrupled.

Although the addition of wind trusses in two horizontal planes is highly effective against torsional oscillations, this method is far surpassed in economy and efficiency by the simple device of installing transverse diagonal stays. With diagonals only one-fifth of the lightest wind-bracing section assumed in the foregoing, the transverse diagonal stays would yield a 50 times greater augmentation of K, also a greater augmentation of R.

TOWER STIFFNESS ALSO HELPS

Tower rigidity, unless it enormously exceeds side-span rigidity, is a negligible factor in increasing the resistance of a bridge to vertical oscillations. The combined effect of the tower participation terms in the writer's formula for K, as applied to vertical oscillations, is found to be only 0.1% in either the Tacoma or the George Washington Bridge. In the case of torsional oscillations, however, a different picture is presented. Symmetric torsional modes (n = 1, 3, 5, ...) require relative deflection of the two tower columns, and this brings into play the torsional rigidity of the tower—including the two tower columns and the transverse bracing between them. The spring constant of the braced tower in torsion is normally many times greater than that of the tower columns as free cantilevers. Even with the flexible columns of the Tacoma Bridge, their torsional rigidity is sufficient to augment the torsional K of the bridge by 50% in the first mode (n = 1), and $1/n^2$ as much in the higher symmetric modes (n = 3, 5, ...). At the same time, for n = 1, R is increased from 0.02 to 0.34. Both rigidity and structural damping are thereby augmented.

The antisymmetric modes (n = 4, 8, ...; also n = 2, 6, ..., without center stays) do not invoke this torsional resistance of the tower, except in a minor secondary effect. This explains why the most dangerous mode (n = 2) is the first torsional mode to appear, unless effective center stays are provided.

OTHER DEVICES INCREASE STABILITY

Torsional stability can be secured or augmented by raising the points of suspender connection, as by the use of deeper girders or brackets. For the Tacoma section, such raising of the center of suspension by 10 ft would have yielded a 91% increase in K, and a consequent 41% reduction in negative damping (δ).

Instead of raising the center of suspension, the same improvement can be accomplished by lowering the center of gravity of the suspended section, for example, by changing from deck or half-through construction to through construction.

To supplement the structural damping, artificial damping devices may be installed, for increased absorption of the energy of oscillations. The artificial damping may be either frictional (solid friction) or viscous (fluid displacement). In the Bronx-Whitestone Bridge, sliding friction damping devices have been installed at the ends of the span to check longitudinal oscillations of the span. For greater direct effectiveness, artificial damping devices can be installed in connection with longitudinal or transverse diagonal stays. The effectiveness of friction damping diminishes with span rigidity K, span length l, and amplitude a. Friction damping is helpful in resisting the initiation of oscillations, but has little effect after any substantial amplitude is attained.

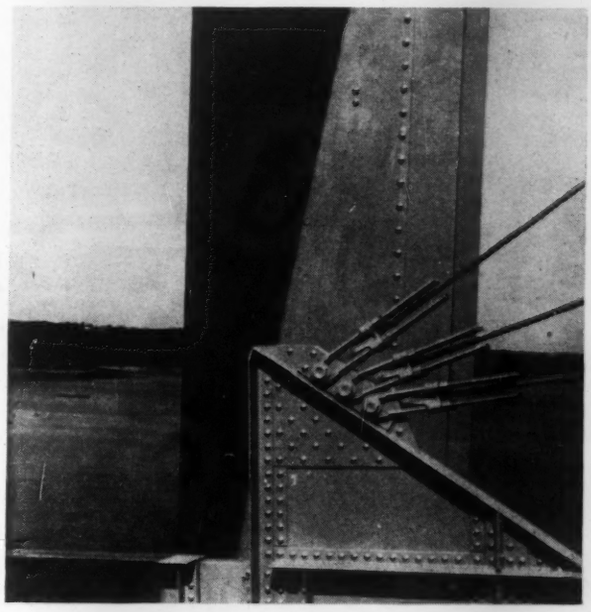
OPTIMUM SECTION RATIOS

For normal bridge sections—including flat plates, H-sections, deck sections, and through sections—aerodynamic characteristics are determined by the section ratio d/b (using the equivalent d/b in the case of truss bridges). Sections with a d/b greater than 0.24 should be avoided, as potentially unstable against vertical oscillations in the high-velocity (catastrophic) range. Section-ratios between 0.10 and 0.17 should also be avoided, as these are the most unstable, for both vertical and torsional oscillations, in the low-velocity range.

For zero or minimum vertical instability, the optimum section-ratios d/b are between 0.22 and 0.24, with a second optimum at d/b close to zero. For zero or minimum torsional instability, the optimum section-ratios are between zero and 0.06. All deeper sections, unless specially modified, are torsionally "unstable" sections, potentially, in the high-velocity (catastrophic) range. As the section-ratio is reduced, the critical velocity initiating the torsional high-velocity range increases toward infinity. For any given section-ratio, but more easily for "stable" sections, vertical and torsional stability up to any specified wind velocity can be assured by providing required values of rigidity, or positive damping, or both.

Modification of the section to reduce drag, as by providing or enlarging openings in the vertical projection or by streamlining, will reduce the effective d/b. This may or may not improve aerodynamic stability, depending upon the resulting augmentation or reduction of the slopes of the lift and torque graphs and any change in sign of the slopes. (To save repeated wind-tunnel tests, the writer has charted the slopes for varying values of d/b.) In some cases aerodynamic stability can be improved by limited increases in the vertical projection of the section so as to change the effective d/b to a more stable ratio.

The early proposal to cut holes in the girder webs of the Tacoma Bridge would have been a mistake, as it would have made the section more unstable both vertically and in torsion, besides weakening the structure. On the other hand, increasing the vertical projection by adding a few inches to the girder height (as by top and bottom dummy ribs of any material) would have improved the vertical stability of the Tacoma cross section by bringing the section-ratio d/b to an optimum value.



LOWER ENDS OF STAYS AT END OF MAIN SPAN, DEER ISLE–SEDGWICK BRIDGE

Streamlining of the cross section (by the addition of fairing) may improve aerodynamic stability, but only when the resulting equivalent section-ratio is consistent with the foregoing recommendations. Complete streamlining (with top and bottom of the H-section covered, and with full semicircular fairing at both girders) tends to produce wind-tunnel characteristics similar to those of a flat plate—an optimum section; but an imperfect job may defeat the purpose.

Partial streamlining may change the equivalent section-ratio to a less favorable value. The proposed

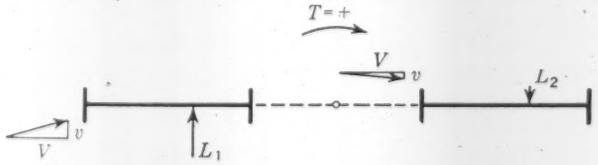


FIG. 3. SECTION AERODYNAMICALLY STABLE IN TORSION ($T = +$)

addition of semicircular or segmental fairing on both girders of the Tacoma section (prices for such installation were being secured on the morning of the failure) would have improved torsional stability to some degree but would have augmented vertical instability, causing the respective vertical modes to appear at lower wind velocities and with higher amplification.

The principal aerodynamic pressure forces causing vertical or torsional instability are developed in the horizontal floor sections near the inside faces of the stiffening girders. By opening these horizontal sections—either by leaving open spaces or by using open-grating construction—the aerodynamic forces causing amplification of oscillations can be eliminated or materially reduced. A completely open deck, or open roadway with closed sidewalks, may lose more in positive atmospheric damping than is gained in reduced aerodynamic instability. The solid middle strip of roadway contributes to aerodynamic stability by atmospheric damping. The opening of lateral areas, however, definitely reduces net aerodynamic instability and may eliminate it. In tests on a scale model of the Tacoma section, open sidewalks yielded an 84% reduction in the net vertical instability, raising the critical velocity ratio V/Nb from 2.30 to the abnormally high value of 6.60.

Another indicated method of eliminating or reducing aerodynamic instability is the use of wide horizontal fins on the outside faces of the girders. These conveniently may take the form of outside sidewalks or roadways on cantilever brackets or girders. Their purpose is to reverse or counteract the aerodynamic effect otherwise produced, so that the negative slopes of lift and torque graphs will be reduced, eliminated, or reversed. A simple T-section with stem turned toward or away from the wind illustrates the effect. Very conveniently, the use of open construction in the normal sidewalk spaces, and the removal of the sidewalks to outside brackets, may be combined in the modification of the cross section. Whether outside brackets will contribute a stabilizing effect depends of course upon the proportions of the section and the category of instability into which it falls.

STABILITY CAN BE SECURED

That aerodynamic stability or instability of a section is a function of the form and proportions of the section, and can be controlled by providing suitably located and proportioned openings in the horizontal width of the section, is now a demonstrated fact. Bridge cross sections can be devised or modified to produce assured aerodynamic stability. One such section consists of two H-sections in line, with the roadway between them removed (Fig. 3). With this gap closed, the section is violently unstable; it is self-starting under wind and will quickly attain angular amplitudes of more than 90°. With the gap open, no applied wind can make the section oscillate, and any artificially applied angular amplitude is almost instantly damped by the wind. The striking aerodynamic stability of this section, as shown by model tests, is explained and predictable by the writer's analysis.

By the various means that have been indicated, resistance to the effects of aerodynamic instability may be built up to any desired amount. These methods resist or check the effects, but do not eliminate the cause.

By scientific design of the cross section, the cause of aerodynamic instability can be very materially reduced, and with some sections entirely eliminated. The one line of attack places the emphasis on providing increased resistance to a dangerous inherent characteristic; the other aims to avoid or eliminate the dangerous characteristic—aerodynamic instability of the cross section.

It is more scientific to eliminate the cause than to build up the structure to resist the effect.

ARTIST'S CONCEPTION OF NEW STATE STREET DOUBLE-LEAF BASCULE BRIDGE, TO BE COMPLETED IN 1946
Work Financed by $3,500,000 Bond Issue, Was Halted by the War

Chicago Board Develops Public Works Program

By PHILIP HARRINGTON, M. ASCE
CHAIRMAN, CHICAGO TRANSIT BOARD, CHICAGO, ILL.

CHICAGO has been one of the nation's three most important war production centers. With the cancellation of war contracts and the release of thousands of workers, it might well be expected that resulting uncertainties would be reflected in the public works program of the city. Fortunately this has not occurred. Chicago has plans; it has a program; and it has the initiative to carry out that program.

During the war those plans were carefully made, for it was realized that such advance planning by all interests—public and private—was necessary to accomplish an orderly transition from war to peace. Private business and industry were largely absorbed in the production of more ships, more planes, more guns, and more ammunition. War industries, therefore, could not be expected to devote attention to postwar planning. Public agencies, however, could, and in the case of Chicago, did take the lead in planning to carry on until industries could be released from their all-important war task.

Machinery for postwar planning was set up in June 1943 by Mayor Edward J. Kelly, M. ASCE, and the City Council of Chicago. Already functioning was the Chicago Plan Commission, and, of course, the various city departments normally concerned with the planning, designing, construction, maintenance, and operation of public works. Two agencies were created, the Economic Advisory Council and the Engineering Board of Review. The Economic Advisory Council, now the Mayor's Advisory Committee, is composed of civic leaders, top-flight executives, and outstanding engineers. Its function is to encourage cooperative planning by public agencies and private enterprise and to aid and advise each group.

The Engineering Board of Review, with which this article deals, is the review agency of the city's postwar planning structure. The Board was created to review and report on proposed local public works so that, at the war's end, Chicago would have an integrated and coordinated program of sound and useful public works construction.

The Board consists of Lloyd M. Johnson, Commissioner of Streets and Electricity, chairman; Philip Harrington, chairman, Chicago Transit Board; Virgil E. Gunlock, Commissioner of Subways and Superhighways; Oscar E. Hewitt, Commissioner of Public Works; Paul Gerhardt, Jr., Commissioner of Buildings; Ralph H. Burke, chief engineer, Chicago Park District; William H. Trinkaus, chief engineer, Sanitary District of Chicago; and George A. Quinlan, superintendent, Cook County Highway Department. Peter F. Girard is projects engineer and George S. Salter is secretary and assistant engineer. (Messrs. Harrington, Burke, Trinkaus, Quinlan, Girard, and Salter are Members ASCE.)

Although the technical staff of the Board is limited, it is authorized, when necessary, to request information, assistance, and advice from all departments of the city and other local government agencies represented on it. The Board may also engage consultants to assist it in the review of engineering plans and projects. The cost of these special services is charged to the project to which the consultants are assigned. Expenses incurred for studies made by the regular staff are pro-rated and paid from the appropriations of the various engineering

bureaus and departments of the local government agencies that are represented on the Board. These payments are made into a $50,000 revolving fund which was established by the City Council to finance the Board's activities.

With the assistance of its technical staff, the Board studies and prepares reports on each project submitted to it for review. The Board also, as a part of each study, includes any project or improvements intimately related to the project under review. This involves the checking of each individual project with the Chicago Plan Commission's master plan studies.

In the past, it was the custom in Chicago, as in other large cities, for each department of municipal government, and each separate local government agency, to plan, blueprint, and supervise the construction of its own public works independently of other local government agencies. Generally speaking, this method functioned creditably and produced many worth-while public improvements, but the war brought about conditions that indicated a change in procedure should be made. For example, at the time the Board was created, Chicago had a sizable backlog of public works projects. Some of these had accumulated over a period of years; others were of more recent date. Superimposed upon these projects were three years or more of deferred maintenance. It was clear that at the end of the war Chicago would be required to proceed simultaneously with two types of public works projects—deferred normal construction and maintenance, and public works to bridge the gap while private industry was retooling.

An inventory of the public improvements proposed by the various local government agencies was compiled by the Chicago Plan Commission. These projects totaled more than $946,000,000, an amount considerably in excess of the local public funds available or likely to become available in the immediate future. Consequently from this inventory of proposed projects—all of them desirable—a limited number of projects had to be selected on the basis of urgent need and availability of funds for construction early in the postwar period.

BIRD'S-EYE VIEW OF CHICAGO'S NEW OUTER DRIVE THROUGH LINCOLN PARK
North Avenue Bathing Beach, to Right, Is Nearly 1½ Miles Long

PART OF LINCOLN PARK EXTENSION, IMPROVED SINCE 1935
Includes Two Cloverleafs on Outer Drive, Bathing Beach, Small Boat Harbor, and Two Free Parking Areas, All on Filled Land

The process of selection is now being performed by the Engineering Board of Review. Its findings, of course, are subject to approval by the City Council, or the local government agency whose project has been reviewed.

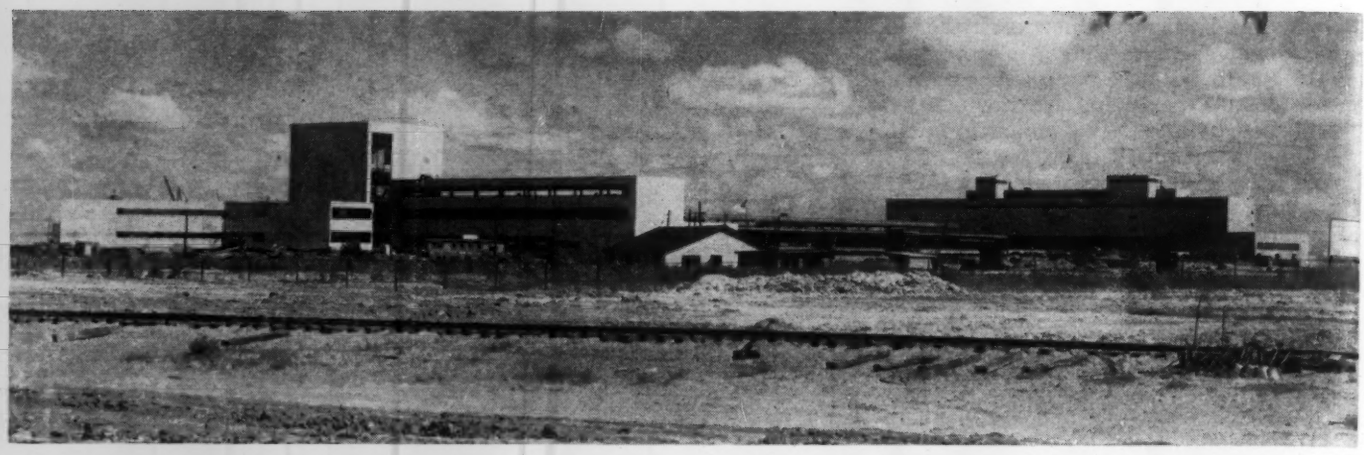
The Board's duties as a fact-finding, advisory body are specified by ordinance as follows:

"For the purpose of developing a sound program of public works and the allocation of available funds for worth-while city projects, and for the integration of city engineering works with projects undertaken or to be undertaken by other local governmental agencies and by private industry, the Engineering Board of Review shall review and make recommendations with respect to the engineering plans, estimates of cost, specifications, design, financial plans, and all general features of construction contracts for all major city engineering projects (operation and maintenance projects excluded) prior to the final adoption or approval by the City Council. It shall make studies, and from time to time make recommendations to the City Council or its committees for more closely integrating the engineering work of the various city departments, bureaus, and agencies looking forward to the more efficient and economical planning and coordination of public works projects with the overall needs of the city."

Since February 1944, the Engineering Board of Review has been analyzing plans, conducting field studies, and ascertaining which of the proposed projects will serve properly the urgent needs of the community and harmonize with the city's master plan. The Board has also concerned itself with the financial aspects of each project it has reviewed.

STREET IMPROVEMENT BASIC

Preliminary study of the list of proposed public improvements revealed that nearly all the projects were related to, and should be considered in the review of, projects for street improvements. Proceeding on this premise, the Engineering Board of Review, up to November 1, 1945, reviewed and reported on 302 projects calling for estimated expenditures aggregating approximately $173,500,000. One hundred and sixty-nine of these projects, involving estimated expenditures totaling approximately $118,829,000, were reported favorably



SOUTH DISTRICT FILTRATION PLANT, FIRST OF THREE PROJECTED FOR CHICAGO
$25,000,000 Plant, with Capacity of 350 mgd of Filtrated Water, Nears Completion

to the council finance committee or direct to the City Council. Of this total, the Board has recommended that the City of Chicago construct 139 projects costing $110,783,000, and that the County of Cook construct 30 projects costing approximately $8,046,000. These projects include bridges, extensions of the city's sewer system, grade separations, street paving and widening, new sidewalks, and new lighting facilities. Approval was withheld for the present on 133 projects but these will be reconsidered later.

During the preparation of separate reports on individual projects, the Board first studied the mile or section-line streets. These thoroughfares are the city's principal traffic arteries. Then the Board made field studies of the diagonal and half-mile streets. Many of these streets are now partly improved. Some were improved by the city as part of its program for modernizing the street system. Others were improved by the county or by the state as part of extensions of state aid or state bond-issue routes. In addition to projects submitted or proposed by other local public agencies, the Board also originated projects and recommended them either for immediate or deferred construction.

Still to be reviewed in detail by the Board are a number of projects, including the $125,000,000 transit modernization and extension program, a $245,000,000 subway-extension program, and the remainder of the city's comprehensive superhighway program, estimated to cost $107,800,000. All these projects have been approved in principle by the City Council.

Although the Board has more work to do in considering relative need and merit of projects proposed for postwar construction, it has compiled sufficient data on each individual project to enable the city or one of the other local government agencies to prepare and submit without delay applications and supporting data for whatever federal or state aid may be available for detailed planning or construction during the postwar period.

SEWER SYSTEMS STUDIED

A case in point is the sewer construction program, proposed by the Bureau of Sewers, Department of Public Works. This program included 17 individual projects aggregating $84,500,000. The Board's report recommended that the individual projects should be set up in a definite time sequence, and that the city should adopt a strong financial plan for frequent allocation of funds for the study, design, and construction of these extensions of the existing sewer system. The Federal Government has recently allocated $393,000 of its postwar planning funds to the Department of Public Works for the designing and planning of these extensions.

Several other major improvement programs have been considered, and in some instances the Board has recommended the allocation of funds for further studies. These include the coordination of city, county, and state highway improvement programs within the city, and a city-wide survey to determine the feasibility of depressing or elevating all railroad tracks within the city.

TEN-YEAR MAJOR THOROUGHFARES PROGRAM

In July 1945, the Engineering Board of Review compiled a 10-year program of improvements of major thoroughfares. This program was based on a study of all major thoroughfares which were then eligible for federal aid or state motor fuel tax funds. Improvements recommended in this program include 33 miles of superhighways, 221 miles of surface street improvements, 61 grade separations, 21 bridges, and 12 viaducts. The estimated cost of the superhighways is $159,200,000 and the estimated cost of the surface street improvements is $78,500,000. Among the recommended superhighway projects is the $50,000,000 West Superhighway (Congress Street), on which construction will start next spring. It will be financed and constructed jointly by the city, the county, and the state under the terms of an agreement whereby each of the three agencies contributes one-third of the cost. Negotiations are getting under way for a similar agreement for financing and constructing the Northwest Superhighway. This superhighway is also a unit of the 10-year program. It will serve the new municipal airport Chicago is to build northwest of the city.

Chicago is favorably known for the thoroughness with which it undertakes and constructs major improvement projects. The work of the Engineering Board of Review is further assurance that Chicago's peacetime program of public works, for the early postwar period as well as for the long term, will be economically sound and useful; that the funds available locally, and whatever money may come from the state and federal governments, will be expended wisely and carefully for urgently needed improvements, and that these improvements will be integrated with existing facilities and with the master plan for Chicago's development.

Chicago is looking forward—and moving forward—in its planning, and is resolved that its preparation for the future, supplemented by its aggressive spirit, can and will fashion in peacetime a great era of community development.

Reservoir Clearing in the Tennessee Valley

Completely Cleared Drawdowns Feature TVA Reservoirs

By HOWARD ELLIS DAVIS

SUPERINTENDENT, RESERVOIR CLEARANCE DIVISION, TENNESSEE VALLEY AUTHORITY, CHATTANOOGA, TENN.

CLEARING stream banks and swamps to make way for Tennessee River valley reservoirs presented many interesting situations. Real economies were effected through the use of special equipment and unique methods, wiring of timber in place being one of them. The organization required for this task ran as high as between 4,000 and 5,000 men.

ON the tributaries of the Tennessee, there is a never-ending cycle in the rise and fall of the water along the mountain slopes behind the dams. The great areas over which the water ebbs and flows are known, in each reservoir, as the "drawdown." Below that elevation the water is supposed never to recede.

For the clearing of a mountain reservoir before impoundage, the Reservoir Clearance Division of the Tennessee Valley Authority divided its work into two types—that within the drawdown, and that below the drawdown. Within the drawdown all timber and undergrowth were cut, piled, and burned, or removed. Below the drawdown, timber that would be submerged at the lowest stage of the lake was left standing, while trees that would pierce the surface of the water at that elevation were felled and wired in place.

Care should be exercised in fixing the policy for storage space in mountain reservoirs. The elevation established as the lower limit of the drawdown automatically establishes the upper limit at which timber can be felled and wired in place. If this contour has been set too high, and the lake is drawn below that elevation, the timber that has been wired will be exposed. In the winter, when there are constant rains, this seems to make little difference; but during the summer, if left exposed too long, the timber—which has become waterlogged from submergence—will dry out. Then, when the lake is again raised, wire that has deteriorated and anchorages that have become weakened will give way and some of the timber will float.

If a good wiring job has been done, even with this unplanned-for interference, only a small percentage of the timber will come up. Unfortunately, most of that which does float will be large. The remedy is to strand the floating trees when the lake is again being drawn down, cut them up, pile and burn the debris.

There were no established sailing lines where trees had to be cut to ground level. Stumps, like outcropping rock, are regarded as natural hazards, to be carefully avoided. But, in the drawdown, unnatural hidden dangers such as concrete foundations, brick buildings, old chimneys, and silos were leveled so that they would not protrude more than 3 ft above the ground. The theory is that if the water over such an obstruction becomes so shallow that the bottom of a small boat can be ripped apart, the occupants of the boat can wade out.

While the malaria mosquito is not usually found in swift mountain streams, it has been learned that if he finds breeding grounds to his liking he will quickly come into the quiet water of the reservoirs. Complete clearing of the drawdown removed the possibility of a retreat for this winged carrier of disease. For mountain clearing, the Division used the same standard clearing unit employed in preparing the Tennessee River reservoirs. This consisted of a unit foreman, three labor foremen, a saw-filer, an ax filer, a clerical first-aid laborer, and 60 workmen.

From the standpoint of safety on steep mountain clearing, the precaution was that no man or group of men move in above or below another. A bounding rock loosened by a careless footstep or falling timber, rolling or sliding logs escaping from a saw crew—all threatened severe injury or death for any who might be below.

In spite of the hazardous nature of the clearing in mountain reservoirs, perhaps because safety practices were so carefully planned and administered to take care of those hazards, the accident frequency rate on all of them except Norris, the first reservoir cleared, was less than on reservoirs in the flat country. There were no fatalities on any of them.

Clearing was done from the bottom upward. When a unit started in a new area, the men were all assigned bush hooks. Working abreast, each man following his own "through," they cut and piled the undergrowth to the top clearing line. Then part of them, retaining their bush hooks, began on a swath parallel to the first. The others, armed with axes, again beginning at the bottom, cut the saplings in the first swath. If it was found that the bush hooks were not going to finish the second swath by the time the axes were out of the first, their number was supplemented. Then the bush hooks began on the third swath, a group of axmen started cutting the saplings in the second, and the remaining axmen were converted to saw crews and began sawing the big timber in the first swath. All the cutting crews were thus smoothly and safely absorbed into the job.

On mountain reservoirs, clearing in the drawdown was coordinated with that in the area below, where the timber was felled and wired in place. It was then possible, especially on the steep slopes, to encourage much of that

TUPELO SWAMPS TO BE CLEARED WERE FIRST DITCHED AND DRAINED
This Ditch Was Dynamited, Others Were Dug by Dragline

cut above to come downhill, entirely out of the drawdown, where it too could be wired. This was much less expensive than trimming and sawing the trees, piling, and later burning the debris.

The best plan was first to slash the timber below the drawdown that was to be wired, then bring in that from above, so that it all could be wired together. Otherwise, the second operation would have knocked loose many of the ties on what had been wired first.

Saw crews always "threw" their trees down a slope. When the declivity was sharp, after the saw had completed its work, and at the last tap of the hammer on the iron wedge, a tree would sway, then leap from the stump and sail through the air like a flying-squirrel. Striking the ground, it often kept going until it came to rest far below the drawdown where, without further conditioning, it could be wired in place.

DIFFICULTIES WERE PRESENTED BY THICK STANDS (SHOWN ABOVE) AND LARGE TRUNKS (SHOWN BELOW)

In those portions of the drawdown areas where timber could not be sent below, clearing was done in the usual manner. First undergrowth was cut and piled. Next the saplings were cut, trimmed, and the brush piled. Their trunks were then cut into lengths of about 12 ft, and those too large to go into the brush piles were left for piling with the larger logs. Finally, the saw crews felled the larger timber, trimmed and piled the brush, and cut the trees into logs. Saw logs, piling, pulpwood, round logs, and other material to be salvaged, both within and below the drawdown, were taken out ahead of the clearing.

Brush was pitched down at least 30 ft from the upper clearing line so that when it was burned the fire would not be swept up into the woods. To keep them from slipping, brush heaps on steep slopes were piled with their tops downhill.

The procedure of the log-piling crews, contrary to that of the cutting crews, was to work from the top clearing contour down. This enabled them to roll the logs down the slope into an accumulation from which they could be more economically put together into piles. When there was footing, mule teams were used to snake the logs together for piling.

To clear timber from precipitous cliff-sides where there was footing for neither man nor beast, men were swung from the top in saddles, suspended by small, flexible wire cables or by ropes with metal centers. To each such man chopping his way down through such a forest there were assigned three good, careful men to handle his rope. This they always kept snubbed around a tree or stump and payed out as he gave the signal.

Along stream banks in the drawdown, small, 25-hp, crawler-type tractors with tail winches were very useful in pulling back the heavy leaning timber as it was cut, or in drawing leaning trees from the streams after they had been felled. Below the drawdown, these machines were sometimes used to pull in the tops of large trees—which had leaned over the water and fallen into the stream—to a position alongside the bank, where they could be wired in place.

On the average mountain reservoir, it was estimated that about 25% of the timber in the drawdown, the clearing of which would have been quite expensive, was thrown or skidded into the area below. Largely because of this economy, regular clearing in the mountain reservoirs was held to a general average of 15 man-days per acre.

Below the drawdown, foremen with hand levels in each unit took shots from the mountain sides to find out which trees would pierce the water surface at the lower limit of the drawdown, the determining contour of which had been plainly marked in red. These trees were felled and wired in place. Those whose tops would be submerged when the water reached the drawdown were left standing.

The possibility for real economy in wiring timber in place, instead of cutting, piling, and burning the debris, always holds out a tempting reward for the operator. But unless the wiring is intelligently and adequately done, the results can be disastrous. Cases have been known where practically all the timber that was supposed to have been wired came up and floated as the reservoir filled. Then, either operations at the dam had to be suspended while the lake was drawn off and the timber cleaned up, or there was a long, expensive job of

CLEARED RESERVOIR BEHIND FONTANA DAM
Brush Is Piled for Burning Above River Banks; Trees Left Standing Will be Completely Below the Drawdown

dragging the floating trees out of the water. If mosquito breeding near populated areas was not too prolific and the state department of health permitted, the timber could be left floating until the lake filled and then was drawn down. As the water receded the timber could be stranded, cut up, piled, and burned. In any case, much flotage from a wired area always resulted in a tremendous additional expense. On TVA reservoirs, flotage emanating from the wired areas amounted to not more than one-half of 1%.

Saplings were drawn back against the stumps from which they had been cut, and fastened in the middle with a single wire. Larger trees required a single wire at both butt and top. As the trees progressed in size, a 2-, 3-, or 4-wire cable was used in place of a single strand. The proposed anchorage, usually a stump, had to be carefully examined. Especially along stream banks, where freshets and drift might occur before impoundage, care had to be taken that ties were made with enough wire to hold the timber.

The ideal tie was a short one, so that the tree would lie snug against the ground. If a long wire were used, the constant up-and-down motion of the log, especially in windy weather when the lake was choppy, would have a tendency to work the wire in two. When the butt of a tree was close enough, it was usually wired to the stump from which it had been cut. But sometimes the top (more especially in the case of timber that had come down out of the drawdown) was not situated right for a good snug fastening, and a long tie had to be made. When this happened, an anchorage was sought directly out in front, which would hold the tree close to the ground rather than at one side, which would permit the tree to float up to the end of a long wire. If an anchorage out in front were not available, then one was sought on each side of the tree, even if at some distance.

Slashing the timber below the drawdown and cleaning up and burning the small broken limbs and other litter was done for a general average of 2.7 man-days per acre. Wiring the timber in place, including the great mass of debris which had come out of the drawdown, ran to 6 man-days per acre, or a total general average of 8.7 man-days per acre for the wiring job. A general average of 300 lb of wire per acre was used.

WORK IN MAIN-RIVER RESERVOIRS

Clearing for reservoirs along the Tennessee River differed somewhat from that done in the TVA's mountain reservoirs, previously described. As the construction of each dam on the Tennessee River was begun by the TVA, the Reservoir Clearance Division built a field organization to prepare for flooding the area that would be covered by the great reservoir of impounded water. Owing to more liberal schedules and less wooded areas to be cleared, Fort Loudoun Reservoir, the uppermost on the river, required an organization of only 300 men. Watts Bar, just below, was prepared with a peak of 500. But the organizations were larger for the other five reservoirs on the Tennessee, ranging from peaks of 1,000 men on Chickamauga to 3,600 on Wheeler.

The operations to prepare these main-river reservoirs for flooding had to be scheduled according to seasons. No farmer was more sensitive to weather conditions than one of these clearing organizations. But its season of greatest industry was pretty well fixed—from the first of June to December. Those were the months when it was reasonably expected that the streams would be low, and when the swamps were driest.

Certain swamp sloughs dried up very late in the season. In fact, if there were heavy summer rains, they did not dry up at all. These had to be drained. Also, most of the tupelo lakes had to be tapped with a good ditch and the water drawn off. Some of the swamps, even late in the summer, persisted in remaining "shoe-mouth" deep in water. Here the heavy undergrowth and small ax saplings were cut out. This let in the air and some of the sun. Presently, the area was dry and in good condition for work.

Ditches constructed only to facilitate clearing, and not related to malaria control, were of no permanent value.

ALONG THE TENNESSEE RIVER TREES WERE LOW-STUMPED FOR SAFE NAVIGATION
Four-Man Crew Sawing at Ground Level

They were dug quickly and economically, without regard for side slopes, over a route so planned as to make necessary a minimum amount of right-of-way clearing and grubbing. If ground conditions were right, laterals radiating from the main ditch could be provided by planting dynamite on 12 to 18-in. centers. A hole several feet deep was made in the muck with a stick or crowbar; the dynamite was dropped in; a stick of dynamite was wired and set off; and with luck the whole ditch, 4 ft deep and 4 ft wide, was blown into being at one time. If an interfering root or other obstruction broke the line of explosion, another stick of dynamite was wired and set off. Often it was possible to drain sizable bodies of water—even tupelo lakes—in this manner. On a tight schedule, of course, more of this drainage, both by dragline and with dynamite, became necessary.

In preparing the Tennessee River reservoirs for flooding, the Division's standard clearing units were employed as previously described; these were small operating organizations working independently of each other. In addition, each unit had a mule team and driver for snaking logs. On stream banks, the units were somewhat expanded. Trees were felled and trimmed and the brush and logs piled separately, ready for the burners.

POWER-DRIVEN TIMBER RAKE DEVELOPED

When work was begun on the big Kentucky Dam Reservoir—the last of the reservoirs to be cleared—the Division had been experimenting for some time to develop a power-driven timber rake. This equipment was first put into productive operation in clearing the Kentucky Reservoir. Coming at a time when labor was extremely scarce, these machines not only took the place of manpower, but considerably reduced the cost of clearing. In fact, except on terrain too rugged for their operation, they completely changed the Division's method of clearing.

Timber now had only to be felled and left, without further conditioning, to be shoved into giant windrows by the rakes. Powered by heavy tractors, the timber rakes were equipped with specially designed curved teeth swung from a bulldozer blade.

On stream-bank work, leaning timber was cut and allowed to fall into the stream, then drawn out by the bank-pulling machines—D6 tractors equipped with a side winch, boom, stiff-leg, and cable. This operation was faster and much less expensive than the alternative of swinging the leaning trees out with blocks and ropes as they were cut.

Before the advent of the Division's timber rake, trees along the banks of a stream were conditioned in the usual manner—they were trimmed and cut into logs, and the brush and logs were piled separately for burning. Now the timber was felled and, without further conditioning, piled by the rakes. If the timber was heavy, congestion could be avoided by dividing this procedure into two operations: first the timber that could be thrown away from the river was felled and shoved into windrows; then that which leaned over the water was cut, drawn out onto the bank by the bank-pulling machine, and raked into the same windrows.

PREPARING THE SHORELINE FOR SAFE NAVIGATION

Along the Tennessee, a good part of the shoreline had to be conditioned for safe navigation by cutting the timber to ground level and beveling the stumps. For a distance of 1,500 ft into many of the estuaries, safety harbors had to be prepared in the same manner. Thus protection from protruding stumps was afforded the big tows of barges that would be traversing the lakes; and during rough weather, or at night, they could find safe anchorages in the quiet waters of the safety harbors.

It is seen that preparing an area along the stream banks of a Tennessee River reservoir was costly in both time and money. As evidence, regular clearing out in the flats of these reservoirs was done for an average of 17.3 man-days per acre; bank clearing ran to an average of 23.3 man-days per acre.

Another, if a lesser, clearing job had to be done after the last summer of work in preparing a reservoir. This job was to eliminate second growth. It was usually completed during the December following, just before the flood season began, when the lake would start filling. It had to be done rapidly, just before the water rose, by many small crews of from 15 to 25 men. Sprouts and bushes were cut with bush hooks and scythe axes, annual growth with horse-drawn or power mowing machines. Heavy-duty horse-drawn farm rakes then brought all this debris together into windrows for burning.

In the Tennessee River reservoirs there were 71,000 acres of this type of clearing, as compared with 13,000 acres on the tributaries. As an evidence of the difference in growth, the cost figures are illuminating; it cost an average of $9 an acre to remove this second growth from the reservoirs on the main river, and $5.45 to remove it from those on the tributaries. So it was because of differences in terrain, nature of the timber, river conditions during the flood season, type of work along the stream banks, and regrowth following clearing, that planning and operations to prepare the Tennessee River reservoirs for flooding differed widely from the corresponding operations for the reservoirs on the tributaries in the mountains.

Idealism for the Embryo Engineer

War and Postwar Years Seen as Offering a Great Variety of Opportunities for Self-Improvement

By L. H. BERGER, M. ASCE

PRESIDENT, C. L. BERGER AND SONS, INC., BOSTON, MASS.

ADVICE often is as wholly disregarded as it is freely given. However, the fact that it costs nothing does not prove it is worth the same. Indeed there are few more valuable favors an older man can do for a younger. Especially in engineering is it necessary to hand down teachings to the coming generation. In Mr. Berger's case, the lessons gain value because he has a businessman's as well as an engineer's viewpoint. His high standards of theory and practice will appeal equally to the mature member and to the embryo engineer. This article was taken from his recent address before the Society's Student Chapter at Northeastern University, Boston, Mass.

EVERY engineer becomes convinced that no branch of science is more dependent on precision than his own vocation. It is well that he does. Since there is no flexibility, no tolerance for errors in mathematics, precision must necessarily be not only the result, but the eternal foundation upon which engineering is based, if it is to stand up.

Those who have watched the work of engineering in this second world war have realized what tremendous effort has gone into military works of offense and defense—some of it soon destroyed. Yet much of it, let us be thankful, will remain useful in the years of peace to come. From the emergencies that arise so swiftly during war, we have seen great construction projects created; from many of them we have learned new lessons in engineering, new approaches and solutions to problems, which are applicable to constructive progress in peace.

PROVIDES AN EXACT FOUNDATION

War itself has become a matter of precision. Peace, from a statesman's viewpoint perhaps, cannot be so precise. But in the field of engineering we are fortunate that we do not have to deal with such unknown quantities as political, economic, and sociological differences which upset the balance of nations. Rather, in engineering, happily enough, we plan our work and see it gain momentum entirely by means of eternal and immortal truths so precise that if we follow these mathematical certainties, we cannot fail to produce the result we desire. Precision is not only the goal of engineering, it is its guardian and its guide.

A producer of surveyors' transits and other precision instruments used in engineering is naturally interested in all branches of science from which man has obtained the materials and the knowledge used in building a surveying tool. Light refraction, optics, metallurgy, higher mathematics, tool design, fabrication—they are just a few of the angles of science we draw upon in creating surveyors' instruments. As engineering advances, its instruments must keep pace. Engineers now starting out on their careers will determine new and better methods and materials in construction work; they will develop increased power sources; they will discover facts in aerodynamics as yet unrevealed; in every branch of engineering they will advance. And as they do so, the instruments with which they work will be improved as a result of their contributions.

All these prophecies must be qualified with a reminder as to the nature of the physical forces an engineer must meet. Nature can be so logical and precise—as in the orderly movements of the planets and constellations—and it can also be so unpredictable and so destructive, as witnessed by hurricanes, tidal waves, landslides, earthquakes, floods, and volcanic upheavals. Up to now, engineering has not been able to predict precisely when or where these disasters will occur, or how severely; but engineering can and does prepare for such emergencies. And when calamity of this sort does strike, it is the engineer who is the restorer and the rebuilder, recreating anew with greater strength, and basing his work on lessons learned from experience with the disaster.

MANY PROBLEMS STILL REMAIN

So the engineer in training is facing a future literally bristling with challenges to his abilities. I do not intend to moralize in this brief discussion; nor shall I indulge in any platitudes about the joy he will feel as he faces the great opportunities that will emerge in the postwar world. Engineering is not an easy profession, no matter how fascinating and satisfying it may be. As was said of geometry by its first great proponent, there is no royal road to it; and there are no high-speed, one-way overpasses by which to reach a desired goal in our profession, in the future world that will need so much reconstruction, so much expansion, after the destructive and cramping years of warfare.

But if the young engineer is truly devoted to the vocation he has chosen, then all the tough problems that may come along he will welcome. At times he will face obstacles that loom large and dishearteningly. But the dogged, tough engineer spirit is not fazed by dilemmas. It faces "hell and high water," figuratively and often literally, and proceeds to conquer every obstacle that comes in its way.

During years devoted to the designing and production of engineering equipment, I have been constantly conversant with a great many of the problems and difficulties that confront engineers in the accomplishment of their tasks, and what it takes to bring those tasks to a successful conclusion. Possibly this qualifies me to speak to the young engineer about equipment—both mechanical and personal.

INDIVIDUAL ABILITY COUNTS MOST

What he learns in school is indispensable. The careful selection of mechanical equipment is also of supreme importance; but it is well to keep in mind that there will always be another priceless ingredient needed to insure a winning combination. Call it "Personal Equipment." Students may be exposed to the same course of instruction and study, all using the same methods to solve the problems involved; but they will not all receive the same marks on tests. No two come with the same personal equipment, nor will they leave equally well equipped, personally. Generally speaking, the same

mechanical equipment—the tangible working tools of the profession—are available to all. We simply go into the market place, make our selection, pay the price, and it is ours.

Personal equipment or personal adequacy is not so easily acquired. It is not tangible or visible. It is not constant, but decidedly variable, and elusive. It is not for sale in the market place, but it may be acquired or increased in the doing of our daily tasks. Like muscular power it is augmented by use. The more of it we bring and apply to our work, the more we acquire and take away.

By daily practice of self-analysis, one finds weak points and fortifies them. He notes the progress he is making in personal adequacy, and as he more and more completely loses himself in his work, he senses a growing power to overcome the inertia within, to master more and greater tasks, to develop an undreamed-of resourcefulness. Quite likely he will unleash a dynamic driving force that will spur him to surmount great obstacles, "unscrew the inscrutable," and conquer the work of the elements.

THE FUTURE, A POSTWAR PROBLEM

Today's engineer belongs to the future. The future must depend upon the engineer for fully half of the physical and industrial reconstruction needed all over this globe. Whether in a drafting room, on some road- or bridge-building project, or connected with vital research or with industrial rehabilitation in Europe or Asia, the young engineer's postwar job is going to be an important part of the whole effort that this unbalanced world must make to get back on an even economic and ethical keel, if civilization is to survive. The engineer is a hard-headed person, usually; the nature of his work requires stability, keen thinking, practicality. I am convinced that if the reconstruction to come were to be left to the engineers rather than to the politicians, the world would arrive at a level of normality as rapidly as the clear-thinking brains of the engineers, and the production of raw materials with which to work, would permit. Such a course would certainly be a radical and a new departure.

Civilization is so constituted that professions and sciences are interdependent. Therefore, the engineering progress of the future will depend on economics, and vice versa. Since the days of the Egyptian Cheops, the pyramid builder, great projects have been the means of either enslaving large masses of people or of providing work and wages. It is to be hoped that the immediate years following the war will be marked by essential rehabilitation and new construction, so planned as to be of permanent economic advantage to the greatest number possible. It is very likely that waste of all sort, duplication of effort, and work of only temporary expediency will be ruled out. And that is how the engineer would want it to be.

We must keep in mind that never before in the history of the world has the engineer faced such a critical and needy civilization. So great will be the demand for engineering skill that projects of vast proportions and great magnitude will be thrust upon the young engineer. Such tasks as were formerly entrusted only to seasoned engineers will invite him to a test of his skill; much sooner than he expects his "big chance" may present itself. How he meets this challenge will very profoundly affect his entire life's work. The present, therefore, are days of preparation; the future will be the "day of decision." Why wait until then? Why should he not take steps here and now so when that day arrives, he will be ready to accept the challenge?

Emerson once said, "Hitch your wagon to a star." I believe there is something more in this slogan than just a flight of imagination, and that if the embryo engineer adopts it, he will be a better student and a better engineer. A low aim avails nothing.

YOUNG AMERICANS HAVE THE WILL TO WIN

There are many reasons why I am glad I was born in America. One of them is the prevailing atmosphere of achievement in which we live. One of the reasons this country has been able to accomplish so much in so short a time is that there are so many Americans who, when faced with a seemingly insurmountable obstacle—an apparently impossible task—have been ready to place a wager on themselves to win.

Recently on the European battleground an American first-aid crew were picking up a wounded G. I. Joe. Nearby another was so badly shattered there seemed to be nothing they could do for him. Bending over him the chaplain asked if he had any last message to send back home. Indicating his uniform the soldier replied; "In that pocket you will find my last sawbuck. I'll bet it with you that I'll live." And he did.

So it should be with the young engineer when he comes face to face with his big chance and finds the odds overwhelmingly against him. As he plumbs the depths of his inexperience, he must be ready to place a wager on his personal adequacy to take over and win. He must say to himself: "If this job can be done, I can do it. For this purpose was I born, schooled, and fitted. I have found my reason for living!" I have confidence in these young Americans because they are enlisted in a profession with a great heritage; they will not only uphold it, but enhance it.

They will help in the development of processes and methods that up to now have been inconceivable. On them depend not only the achievements of the engineering profession but the advancement of all mechanized industry, of city growth and planning, of inter-state and international communication—the list is almost endless.

HONESTY IN ENGINEERING PRACTICE

Pure science is truth. Nearly two thousand years ago, a certain humble Friend of Man told the little group around Him that "the truth shall make you free." Himself only a primitive carpenter, so history tells us, He may not have envisioned the unfolding of science as we know it today. Yet His observation about truth applies to all things, including precise science, which, as we study and apply it, proves, and proves again the truth. The student of engineering has chosen a career that must be founded upon truth as it is revealed in his study and practice. There is no need to advise him to cleave to the truth; he cannot separate himself from it if he be a true engineer. New truths, founded on those we know today, will be discovered in the coming years—and it will be the young engineer's privilege to make these truths function in his own achievements, as a lasting contribution towards a higher, cleaner civilization, in a better, more rational world.

Monuments have been erected memorializing some brilliant and extraordinary engineering feats, many of which seemed almost insurmountable at the time and were accomplished only under the severest—oftentimes untold—hardships. But these monuments pale in comparison with the works which these intrepid engineers have left to posterity. They have memorialized themselves to humanity far better by the completed projects they have left behind—enduring examples to inspire and benefit mankind throughout the ages.

OUR READERS SAY—

In Comment on Papers, Society Affairs, and Related Professional Interests

Role of Mrs. Roebling in Building Brooklyn Bridge

To the Editor: It occurs to me that, in connection with the "re-unveiling" of the Brooklyn Bridge, on December 2, 1945, sponsored by the City Hall Park Association, it would be fitting to have some public record of the contribution made to the building of the Brooklyn Bridge by Mrs. Emily Warren Roebling, wife of Col. Washington Roebling. Very few people are aware of the immense help that the great engineer received from his wife, when the colonel was permanently crippled toward the beginning of the work.

The public attacks made on Col. Washington Roebling when he took charge of the Brooklyn Bridge and improved on his father's plan had to be met from his sick bed, and he could not have met them if his wife had not been of the same heroic mold. Seth Low, who was mayor of Brooklyn at the time, introduced a resolution to replace Colonel Roebling as chief engineer.

Mrs. Roebling, who had studied mathematics of bridge building, strength of materials and stress analysis, bridge specifications and cable construction, visited the bridge each day as inspector and spokesman for the colonel, making herself a competent engineer. She attended a meeting of the American Society of Civil Engineers, an unprecedented step in those days, and eloquently pleaded her case before that body, winning the unanimous support of the Society and the defeat of Seth Low's campaign. Thus, in my judgment, the Brooklyn Bridge is a memorial to her as much as to her husband and his father, John A. Roebling.

Particularly at this time, while the rehabilitation of the Brooklyn Bridge is in progress, it would be fitting to have some public recognition of the contribution made to the building of the bridge by Mrs. Roebling. That engineers recognize her importance is attested by Dr. D. B. Steinman's mention of her in his recent book, *The Builders of the Bridge.*

Brooklyn, N.Y. Theodore Belzner, Affiliate ASCE

Trouble Between the Panhandles

To the Editor: The quotation from Shakespeare, "The evil that men do lives after them; the good is oft interred with their bones," is most applicable to the work of certain cadastral surveyors in 1859–1860 and 1881. The General Land Office, the Texas and Oklahoma legislatures, landowners and county officials in the Panhandle, and Congress will bear this out, though none of the surveyors were in any way evil men!

At the Oklahoma Panhandle the state is only about 35 miles wide, north and south. This strip lies between the extreme northerly edge of Texas and the south borders of Kansas and Colorado. Between this and the Texas Panhandle there is a land "splinter," 165 miles long and as much as 475 ft wide at Texhoma near the middle; the towns of Hitchland and Texhoma lie squarely across it. The country is now reasonably well improved, and oil and gas wells nearby make conditions more exciting. Who can say there isn't oil under what an owner hopes is his land! Early Oklahomans and Texans little knew the trouble they were brewing when, for the most part, they disregarded the 16 monuments John M. Clark set in 1859–1860 to mark the northern boundary of Texas.

Oklahoma's Panhandle and contiguous areas of Kansas, New Mexico, and Colorado were once a part of the Republic of Texas. When that republic was annexed to the United States, its northern boundary was set at parallel 36° 30′ between the 100th and 103d meridians, Clark officially marking that line. The remaining former Texas lands became public lands of the United States for settlement. However, the Clark boundary survey was not confirmed by Congress and the State of Texas until 1891, and by the Supreme Court of the United States until 1926.

Meanwhile, in 1881 General Land Office surveyors Chaney and Smith laid out the 165-mile Cimarron Base Line approximately athwart the Texas northerly boundary, with easily identified corner monuments at half-mile intervals, for use in the subdivision of the public lands to the north. Some points on the base line actually were on the Texas-Oklahoma line, but at Texhoma and to the west this was not the case.

Most Oklahoma settlers were not aware that the Cimarron Base Line wasn't a boundary. Titles for their land, however, mostly use it as such; whereas, Texas titles are clear and recognize the official status of the Clark survey. However, no retracement of Clark's work was ever made until long after many improvements and titles had been made. When suits started about the disputed "splinter" areas, the General Land Office resurveyed the region and subdivided it south of the Cimarron Base Line. Meanwhile, many landowners, in an effort to keep their titles clear, have been paying taxes to both Oklahoma and Texas.

At this late date the only relief possible is by special congressional legislation. During the past two Congresses bills to obtain such relief have been introduced. Generally these bills provide relief to disputed ownership of 10 years' duration (one bill makes it 20 years). Meanwhile, well-meaning and reputable cadastral surveyors will have greater peace of mind if they do not have to work along the Panhandle's common boundary! It's a place for a judge, not an engineer.

Rochester, N.Y. Ralph Z. Kirkpatrick

Computing the S-Polygon

Dear Sir: I was interested in the article by Mr. Blankenburg on "Unsymmetrical Bending and S-Polygons," in the October issue, in which an analytical demonstration was given for the S-polygon. A simpler and more easily remembered, although perhaps less elegant, proof is as follows:

For the intercepts on the X- and Y-axes substitute:

$$S_{AB} = e;\ S_{BC} = f;\ S_{CD} = g;\ S_{AD} = h$$

Rewrite the equation for f_B as follows:

$$f_B = \frac{-M}{\frac{S_{AB} \cdot S_{BC}}{S_{BC} \cdot \sin\theta + S_{AB} \cdot \cos\theta}} = \frac{-M}{SB} \quad \ldots\ldots (1)$$

In the first quadrant, twice the area of the total triangle is equal to the sum of twice the component triangles above and below S_B as follows:

$$S_{AB} \cdot S_{BC} = S_{AB} \cdot x + S_{BC} \cdot y \quad \ldots\ldots (2)$$

Substitute $x = S_B \cdot \cos\theta$ and $y = S_B \cdot \sin\theta$—and solve for S_B:

$$S_{AB} \cdot S_{BC} = S_{AB} \cdot S_B \cdot \cos\theta + S_{BC} \cdot S_B \cdot \sin\theta \quad \ldots (3)$$

Therefore,

$$S_B = \frac{S_{AB} \cdot S_{BC}}{S_{BC} \cdot \sin\theta + S_{AB} \cdot \cos\theta} \quad \ldots\ldots (4)$$

Similarly, for the other three quadrants. The sequent equations for S_B and S_D given by Mr. Blankenburg are merely trigonometric variants of Equation 4.

Austin, Tex. Arnold Staubach, Assoc. M. ASCE

Additional Comments on Metric System

Dear Sir: Objection has been taken by other writers on the metric system to my statement, in the July issue, that "Since Great Britain and the United States have done more with feet and inches than the rest of the world has done with meters, the rest of the world could change to feet and inches more easily than we could change in the opposite direction."

In the countries where the metric system is in use, so many non-metric measurements are used by a substantial portion of the population that there surely must be many millions of people who have never heard of meters. On the other hand, can anyone imagine a man or woman in the United States or England who is not familiar with feet and inches?

Furthermore, the actual use of feet and inches in the United States and England is both extensive and intensive, while in many of the metric countries there is, in proportion to the population, far less use of any kind of measurements. So the quoted statement is entirely fair and is no criticism of other countries.

The advocates of our "adoption" of the metric system actually are urging that it be made compulsory. That is the way it was adopted in other countries, even at a time when those countries were in a condition of only elementary industrial development. And only a compulsory law could force it upon us.

Aside from the disrupting effect that a change to the metric system would have upon business and industry, there are many other details of our affairs that would necessarily be changed. For example, consider merely the single items of re-dimensioning all the millions of deeds to real estate.

New Rochelle, N.Y. LEONARD C. JORDAN, M. ASCE

Recollections of the Old Pecos River Bridge

TO THE EDITOR: The interesting and instructive article, "New Cantilever Carries Southern Pacific Over Pecos River," by Harry J. Engel, in the October issue, brings recollections of a year, in the late twenties, spent on construction work, near Del Rio, Tex., which is some sixty miles east of the new bridge.

The story of the contractor and the steel erector can be partially read between the lines by one who has seen that part of the West. Their problems could not have been "ordinary" in the region of "wide open spaces."

Another story, which is part of the lore of the West, has been told by John A. Lomax, in his book, *Cowboy Songs and Other Frontier Ballads* (the Macmillan Co.). The skeleton-like towers and chords and bracing, made to seem more delicate because of the great height of the old bridge, may well explain why the cowboys of fifty years ago sang as they did of "The Pecos Queen."

Where the Pecos River winds and turns in its journey to the sea,
From its white walls of sand and rock striving ever to be free,
Near the highest railroad bridge that all these modern times have seen,
Dwells fair young Patty Morehead, the Pecos River queen . . . .

She is known by every cowboy on the Pecos River wide,
They know full well that she can shoot, that she can rope and ride.
She goes to every round-up, every cow work without fail,
Looking out for her cattle, branded "walking hog on rail."

She made her start in cattle, yes, made it with her rope;
Can tie down every maverick before it can strike a lope.
She can rope and tie and brand it as quick as any man;
She's voted by all cowboys an A-1 top cow hand.

Across the Comstock railroad bridge, the highest in the West,
Patty rode her horse one day, a lover's heart to test;
For he told her he would gladly risk all dangers for her sake—
But the puncher wouldn't follow, so she's still without a mate.

Norris, Tenn. WARREN A. NILES, Assoc. M. ASCE

Bond Requirements in Concrete Design

DEAR SIR: Two Joint Committees have worked on the important subject of Standard Specifications for Concrete and Reinforced Concrete, with reports published by the Society in PROCEEDINGS—the first in the October 1924 number and the second in the June 1940 issue, Part 2.

In attempting to convert my design standards from the 1924 to the 1940 code, I have run into some difficulties in interpreting the requirements for bond, both ordinary and end anchorage, as follows:

1. Under Section 829 (*e*) it is stated that one-fourth of the positive steel should extend into the support. How many diameters should this be?

2. I have assumed that the foregoing statement could also hold true for positive steel at the exterior column end of a continuous beam. Is this correct?

3. Section 827 states that all longitudinal bars should be provided with end anchorage, where higher stresses are used, and Section 828 requires that this additional length be added to ordinary anchorage. Now, assuming under (1) above, 20,000-lb steel stress and 12 diameters into supports, would end anchorage add 16 diameters additional or 28 diameters into supports? This obviously is all out of reason, as these bars need only be extended 24 diameters for compression.

4. Section 829 (*f*) requires that one-third negative steel be extended 16 diameters (20,000-lb steel stress) beyond the point of inflection. Would end anchorage add 16 diameters more to this or a total of 32 diameters?

5. At the exterior column end of a continuous beam there is a 16-diameter hook sufficient for the negative steel. Under the 1924 code these bars were bent down the beam depth where the support was less than three-quarters of the beam depth.

I would deeply appreciate it if the Committee would clarify these few points.

Alexandria, La. LEROY A. STAPLES, M. ASCE

DEAR SIR: In regard to Mr. Staples' questions, I can well understand his difficulty. Having carefully studied the sections to which his questions refer, I believe that the following is the interpretation intended by the Joint Committee. My answers refer by number to his questions.

(1) In Section 829 (*e*) there is definitely an omission. The report should have given some limit. In the absence of any such limit I would assume that the Committee intended the same value to apply as given in 829 (*c*), namely, 12 diameters. Clearly the Committee did not intend that the extension of the bars into the support would be merely nominal. By the position of the requirement in the text, one must assume that either the limit given in (*c*) (12 diameters) or the limit given in (*d*) or (*f*) (to develop one-half allowable stress) would apply. Since the requirement is purely an arbitrary one, I believe the 12 diameters would be a fair interpretation.

In support of this interpretation, I would point out that in the most recent American Concrete Institute code, which follows the Joint Committee rather closely in this section on anchorage, a limit of 10 diameters has been placed.

(2) I think the interpretation here is correct.

(3) The point raised here is certainly not covered in the Joint Committee recommendation. The reason for this, I believe, is that the Committee did not consider this a problem. Positive reinforcement, when carried into the regions of negative moment, is in compression, and no amount of hooking or additional length could be considered of value in increasing the shear resistance or resistance in bond in reinforcement in the opposite face of the beam where tension exists.

(4) I would interpret the recommendations on this point as follows: Normal anchorage for the steel so extended at 10,000 lb per sq in. would require 16 diameters, using 150 lb per sq in. as the bond value (deformed bar, $f_c' =$ 3,000 lb). If it were desired to take advantage of the provision for end anchorage, the permissible unit stress in bond would be 225 lb per sq in. and the length of embedment would be $\frac{2}{3} \times 16 = 11$ diameters. To this should be added the length of hook or special anchorage calculated at 10,000 lb per sq in. steel stress and the original 150 lb per sq in. in bond. This requirement, which is in accord with the third sentence of Section 828, calls for 16 diameters, which would make the total length of bar beyond the point of inflection 11 diameters + 16 diameters = 27 diameters.

(5) The interpretation here would depend on the degree of resistance intended at the exterior column. If the design contemplates the equivalent of a rigid frame, paragraph 829 (*b*) would apply. The anchorage for the maximum tension (assumed as 20,000 per sq in.) at the normal bond value of 150 lb per sq in. would be 33 diameters. If special anchorage were employed, the higher unit would reduce this by one-third, leaving 22 diameters, to which should be added the 16-diameter length necessary to develop 10,000 lb per sq in., making a total of 38 diameters.

In offering these explanations I am expressing my own interpretation, which I believe is a fair one. However, I do not know whether all the members of the Committee would agree.

F. R. MCMILLAN, M. ASCE
Director of Research, Portland Cement Association (Secy-Treas. of the 1940 Joint Committee)

Chicago, Ill.

SOCIETY AFFAIRS

Official and Semi-Official

Society Prizes and Medals to Be Awarded

Members to Be Honored at the Annual Meeting for Outstanding Contributions to Society Publications

FOLLOWING its usual custom, the Society will present prizes and medals at the Annual Meeting, which will be held in New York City from January 16 to 18, 1945. Oldest and most important of these awards is the Norman Medal, established in 1872 by the late George H. Norman, M. ASCE, for an original paper which is considered an especially notable contribution to the profession. Next in distinction is the J. James R. Croes Medal, which was established by the Society in 1912 and named in honor of the first President.

In 1884 the late Thomas Fitch Rowland, Hon. M. ASCE, endowed the prize bearing his name for a paper best describing in detail some accomplished work of construction. For the paper considered next in merit to that receiving the Thomas Fitch Rowland Prize, the Society in 1912 established the James Laurie Prize, which was named in honor of the first President.

On his retirement as Secretary of the Society in 1894, the late Francis Collingwood, M. ASCE, established the Collingwood Prize for Juniors. Papers eligible for this award must describe an engineering work or record an important investigation with which the author has been connected. Another governing factor in the selection of papers receiving this prize is excellence of style.

In a somewhat different category are the Division Prizes, which will also be presented at the Annual Meeting. Oldest of these Division awards is the Rudolph Hering Medal, which was endowed in 1924 by the Sanitary Engineering Division of the Society. Normally this award goes to the paper adjudged the most valuable contribution to the advancement of the sanitary branch of the profession. This year, however, the award goes to Langdon Pearse in his capacity as chairman of the Committee of the Sanitary Engineering Division on Sewerage and Sewage Treatment that prepared the second progress report, appearing in the April 1944 PROCEEDINGS.

The Karl Emil Hilgard Prize in Hydraulics was instituted in 1939 as a result of an endowment left to the Society for the purpose by the late Karl Emil Hilgard, M. ASCE, of Zurich, Switzerland. This prize, consisting of a cash award of $50, is given only once in two years, and its administration is under the Hydraulics Division of the Society.

The J. C. Stevens Award, which was established in 1943, goes to the author of the best discussion of a paper published in TRANSACTIONS in the field of hydraulics. The award is made on the recommendation of the Hydraulics Division and consists of books costing not more than $50, to be selected by the recipient.

Biographical sketches of the recipients of these prizes and medals follow:

MERRILL BERNARD, recipient of the Norman Medal, is prominent in the fields of hydraulics and hydrology. He was educated at the Military College of South Carolina and Oklahoma Agricultural and Mechanical College, taking special courses later at the University of Michigan and the University of Wisconsin. He served as first lieutenant in the 19th Infantry during World War I and then returned to establish a consulting practice in municipal, irrigation, and drainage engineering with offices in Crowley, La. In 1934 he became hydrologic consultant to the Mississippi Valley Committee, aiding in pioneer hydrologic investigations, and during 1936 and 1937 he served as hydraulic engineer with the Soil Conservation Service on the development of their laboratory and research program. In 1937 he joined the staff of the U.S. Weather Bureau as chief of the River and Flood Division, later becoming hydrologic director. In the latter capacity Mr. Bernard has directed the nation-wide river and flood forecasting service of the Bureau, hydrometeorological and hydroclimatic programs in cooperation with the Corps of Engineers, and during the recent war served in posts in connection with the military meteorological work of the Bureau. He was a member of the American Meteorological Mission to the Union of Soviet Socialist Republics in 1945 and one of the small group of American scientists invited to attend the 220th anniversary of the Russian Academy of Sciences. Becoming a full Member of the Society in 1926, Mr. Bernard is a member of the Society's Committee on Hydrology, and chairman of the Research Committee on Precipitation. He is, also, a member of the executive committee of the Section of Hydrology, American Geophysical Union, and a member of the Washington Academy of Sciences. He has contributed numerous articles on hydraulics and hydrology to government and other publications.

GEORGE H. HICKOX, winner of the J. James R. Croes Medal, has been on the staff of the Tennessee Valley Authority since 1935. He was educated at the State University of Iowa where he majored in hydraulic engineering, receiving B.E. and M.S. degrees in 1925 and 1926. In 1926 and 1927 he was instructor in applied mathematics at Albion College, Albion, Mich. He then spent five years with various engineering firms, including the West Virginia Power and Transmission Company and the Morgan Engineering Company, on such varied work as power economics, drainage, flood control, irrigation, and hydrologic studies. In 1932 he returned to teaching at the University of California, where he taught hydraulics and engaged in hydraulic research and graduate work that culminated in his winning the Ph.D. degree in 1939. Mr. Hickox joined the staff of the Tennessee Valley Authority in 1935 as head of the hydraulic laboratory where he has since been in charge of all hydraulic model tests on TVA dams and other structures. In 1934, with G. O. Wessenauer, he was awarded the Collingwood Prize. A full Member of the Society since 1940, he is now serving on the Committee on Hydraulic Research. He is author, with M. P. O'Brien, of *Applied Fluid Mechanics* (1937) and a contributor to *Handbook of Applied Hydraulics* (1942).

DONALD N. BECKER, long in the field of public service, is this year's recipient of the Thomas Fitch Rowland Prize. His early education was received in the public schools of Utica, N.Y., the city of his birth, and in 1908 he received the degree of Civil Engineer from Rensselaer Polytechnic Institute. He was elected to Sigma Xi and Tau Beta Pi, honorary fraternities. One year as an instructor in mathematics at his alma mater followed his graduation. He then (1909) entered the service of the Chicago, Milwaukee and St. Paul Railway at Chicago, as a draftsman in their bridge department, remaining there, except for three months with the American Bridge Company, until March 1912. In the latter month he entered the service of the City of Chicago as a bridge engineer under civil service. In September 1924 he was promoted, under civil service, to the position of engineer of bridge design. Since then he has been in charge of the design of movable and fixed bridges and viaducts, valued at about $30,000,000. In addition to the paper for which Mr. Becker is receiving the present award, he contributed to CIVIL ENGINEERING for March 1942 on the "Design and Construction of the N. State Street Bridge, Chicago," and to the September 1943 issue on "Early Movable Bridges of Chicago." He has been a Member of the Society since 1939.

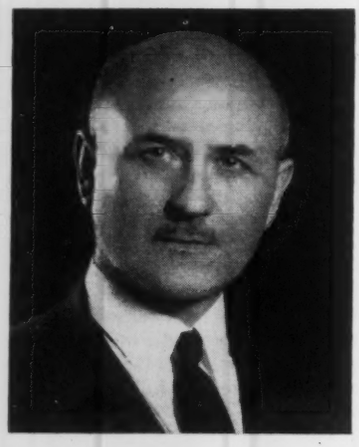
OLE SINGSTAD, winner of the James Laurie Prize, was born and educated in Norway, receiving the degree of C.E. from the Polytechnic Institute at Trondheim in 1905. In the same year he came to the United States. There, after three years of railroad design and construction, he took up tunnel work and has spent most of his professional career in the design and construction of rapid-transit subways and tunnels, vehicular tunnels, and heavy underground structures. For the past 25 years he has been a pioneer in the development of the modern vehicular tunnel for automotive traffic. He was the designing engineer and, later, chief engineer for the Holland Tunnel and developed its novel ventilation system.

MERRILL BERNARD
Norman Medal for Paper, "Primary Role of Meteorology in Flood Flow Estimating"

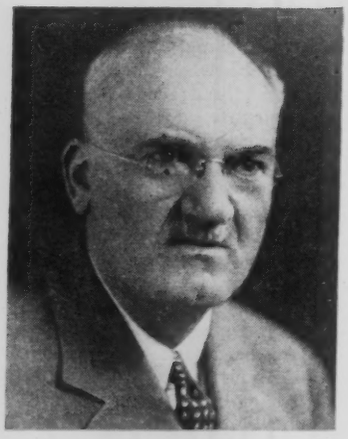
GEORGE H. HICKOX
J. James R. Croes Medal for Paper, "Aeration of Spillways"

DONALD N. BECKER
Thomas Fitch Rowland Prize for Paper, "Development of the Chicago Type Bascule Bridge"

OLE SINGSTAD
James Laurie Prize for Paper, "The Queens Midtown Tunnel"



CARL E. KINDSVATER
Collingwood Prize for Juniors for Paper, "The Hydraulic Jump in Sloping Channels"



LANGDON PEARSE
Rudolph Hering Medal for Second Progress Report of Committee on Sewerage and Sewage Treatment

L. STANDISH HALL
Karl Emil Hilgard Prize for Paper, "Open Channel Flow at High Velocities"

THOMAS R. CAMP
J. C. Stevens Award for Paper, "Effect of Turbulence on Sedimentation"

He was, also, chief engineer in charge of the planning, design, and construction of the Queens Midtown Tunnel and the Brooklyn-Battery Tunnel, and has served as consultant on many important vehicular tunnels here and abroad, including the Scheldt River Tunnel at Antwerp, Belgium. For his services on the latter project he was decorated with the Order of the Crown. Mr. Singstad recently retired as chief engineer of the New York City Tunnel Authority, and is now a practicing consulting engineer in New York. Holder of honorary degrees of doctor of engineering from New York University and Stevens Institute of Technology, Mr. Singstad is lecturer on foundation engineering at Harvard University and on soil mechanics and foundation engineering at New York University. He is also a member of the advisory council, department of civil engineering, at Princeton University, and past-president of the American Institute of Consulting Engineers. Becoming a full Member of the Society in 1923, he has served a term as Director and is a past-president of the Metropolitan Section. At present he is representing the Society on the Board of Directors of the American Standards Association.

CARL E. KINDSVATER, recipient of the Collingwood Prize for Juniors, received the Kansas Section's 1935 prize of Junior member-

ship in the Society. He was graduated from the University of Kansas with a B.S. degree in civil engineering in 1935, and then attended the State University of Iowa, receiving an M.S. degree in hydraulic engineering. He was made a member of Tau Beta Pi at the University of Kansas, and of Sigma Xi at the University of Iowa. While doing graduate work at the latter he was a research assistant at the Iowa Institute of Hydraulic Research, and it was also during this period that he assisted the late D. L. Yarnell, M. ASCE, in the research that led to his paper, "The Hydraulic Jump in Sloping Channels." From 1937 until 1943, he was employed by the Tennessee Valley Authority, successively in the hydraulics laboratory at Norris, Tenn., and in the flood control section at Knoxville. From 1943 until December 1945 he was associate hydraulic engineer with the U.S. Engineer Office at Little Rock, Ark. At present he is associate professor of civil engineering at Georgia School of Technology, where his principal immediate concern is the development of a new hydraulics research and teaching laboratory.

LANGDON PEARSE, who is widely known in the field of sanitary engineering, is this year's recipient of the Rudolph Hering Medal. After graduating from Harvard College, with the degree of A.B. in 1899, he studied at the Massachusetts Institute of Technology, receiving the degree of B.S. in Civil Engineering in 1901, and the degree of M.S. on "Studies in Sanitary Science and Advanced Structures" in 1902. Following short engagements with the State of Massachusetts, he served as assistant engineer with the Commission on Additional Water Supply, New York City (1903), the Augusta (Me.) Water District (1904), and as personal assistant to George C. Whipple, on water supply investigations of Jersey City and Cleveland, Ohio. Then, for over four years he was assistant engineer on the improved water and sewage work at Columbus, Ohio, and for one year with the Peoples Water Company, of Oakland, Calif. Since February 1909, he has been sanitary engineer for the Sanitary District of Chicago, in charge of sanitary investigations and sanitary engineering work, concerned with the construction, design, and operation of various intercepting sewers and sewage treatment works. He has appeared as expert witness for the Sanitary District of Chicago in the lake level litigation, on sanitary subjects, and in various congressional and legislative hearings; also as expert witness for the states of Illinois, New Jersey, and Connecticut in connection with litigation. His duties have also covered the development of the sewage treatment program of the District to supplement dilution, and in connection therewith he has been concerned with every sewage treatment works the Sanitary District has built, in more or less degree, and with its experimental work on sewage treatment and industrial wastes. In 1938 Mr. Pearse served as editor for an anniversary volume for the Federation of Sewage Works Associations, entitled "Modern Sewage Disposal." He has also prepared various papers on sewage treatment for technical societies, and for over 15 years has served as chairman of the Committee on Sewage Treatment of the American Public Health Association. He has been a Member of the Society since 1913, and for the past four years has been chairman of the Society's Committee on Sewerage and Sewage Treatment.

L. STANDISH HALL, winner this year of the Karl Emil Hilgard Prize, graduated from the Massachusetts Institute of Technology in 1914 with an S.B. degree in civil engineering. After several brief engagements, including a year with the U.S. Office of Public Roads and a year on master plans for an industrial village for the Delco Company south of Dayton, Ohio, he was for seven years assistant engineer for H. L. Haehl, M. ASCE, and San Francisco consultant. In 1924 he entered the service of the then newly organized East Bay Municipal Utility District of Oakland, Calif., and under the direction of the late Arthur P. Davis, Past-President of the Society, served as assistant engineer on the preliminary studies and the final plans for the $39,000,000 Mokelumne water-supply project. In 1926 he was advanced to chief hydrographer in charge of investigations involving water-rights litigation to determine the effect of the District's diversion from the Mokelumne River on the water supply to wells in the area. In 1936 he was made hydraulic engineer and, later, principal hydraulic engineer, which position he now occupies. In addition to water-rights and ground-water investigations, his professional work with the District includes stream gaging and hydrographic surveys; hydrology; river regulation and flood control; hydraulic research and model tests; city planning and land use analysis; and design or operation studies of dams, spillways, hydraulic structures, and of irrigation, drainage, and reclamation projects. He has, also, served as consultant on hydraulic problems for several organizations. In 1921 he was awarded the Collingwood Prize for Juniors for his paper, "The Probable Variations in Yearly Runoff as Determined from a Study of California Streams." He is now a full Member of the Society.

THOMAS R. CAMP, recipient in 1941 of the Karl Emil Hilgard Prize for his paper on "Lateral Spillway Channels," now wins the J. C. Stevens Award. A native of Texas, he was graduated from the Agricultural and Mechanical College of Texas in 1916. For the next seven years, except for 18 months' service in the U.S. Army during the first World War, he was associated with the late John B. Hawley, M. ASCE, and other Texas engineers in municipal engineering practice. From 1923 to 1925 he took postgraduate studies at the Massachusetts Institute of Technology, receiving the master's degree in civil engineering in 1925. From the latter year to 1928, he was in municipal engineering practice in North Carolina under the firm name of Spoon, Lewis and Camp; and for the following year he was principal design engineer for the late Alexander Potter, M. ASCE, in New York. From 1929 to 1944, Mr. Camp was associate professor of sanitary engineering at the Massachusetts Institute of Technology. For the past two years, he has been in full-time consulting practice in the field of sanitary engineering with offices in Boston. He has done considerable research and development work in hydraulics and in sanitary engineering, and has written extensively in these fields. He has been a full Member of the Society since 1930.

Society Gains Three New Honorary Members

BORIS ALEXANDER BAKHMETEFF

WELL KNOWN in his chosen field of hydraulics is Boris A. Bakhmeteff. Although he was born in Tiflis, in the Caucasus area of Russia (in 1880), he has been in the United States since 1917 and a citizen since 1935. Following graduation from the Tiflis Classical Gymnasium he studied at St. Petersburg, receiving his C.E. degree at the Institute of Engineers of Ways of Communications there. In 1903, the following year, he studied at the Zurich Polytechnic Institute, and later received a doctor's degree in engineering from the Polytechnic Institute of St. Petersburg.

For twelve years following 1905 he taught at the Institute Emperor Peter the Great in St. Petersburg, becoming professor of general and advanced hydraulics, hydraulic structures, water power engineering, and theoretical and applied mechanics. During most of this period (1907–1915) he was also a consulting engineer specializing in water power.

At the beginning of the first World War, in 1915, he gave up this work to enlist with the Red Cross. He became chief plenipotentiary of the Central War Industrial Committee to the United States, and a member of the Anglo-Russian Purchasing Commission. In 1917 he was sent to the United States as undersecretary of state (vice-minister) in the Ministry for Commerce and Industry of the Provisional (Kerensky) Government, and continued in Washington as ambassador of the State of Russia until 1922.

BORIS A. BAKHMETEFF
New Honorary Member

In 1923 he set up a consulting practice in New York City, which he still maintains. Since 1931 he has been professor of civil engineering at Columbia University.

His interests are wide. Those in the technical field are evidenced by his many affiliations with pro-

fessional and other groups. He is director of the Humanities Fund, Russian Student Fund. He is a Fellow of the American Geographical Society, Foreign Policy Council, and of the Institute of Aeronautic Sciences. Organizations in which he holds membership include the American Association for the Advancement of Science, the New York Academy of Sciences, the Connecticut Academy of Arts and Sciences, Tau Beta Pi, and Sigma Xi.

As might be expected, he is a linguist of no mean order. More remarkable, he has a splendid grasp of English. In this connection he has become recognized as a public speaker, whose diction, expression, and fluency might well serve as a model for native born Americans.

He has a well-developed business ability, which has given him responsibility in connection with a number of industrial enterprises. His special interest is in the Lion Match Company, one of the leaders of its field, of which he is chairman of the board.

Among hydraulicians, Professor Bakhmeteff is recognized not only as an authority on fluid flow but as an outstanding exponent of what may be called "the new hydraulics." Hydraulic investigations during the nineteenth century were devoted almost entirely to "coefficient research," to attempts to determine the modifying factors essential in applying basic equations in full-scale design. Even such a pioneer American investigator as Clemens Herschel insisted that the mathematical complications which were being developed by physicists and by such investigators as Reynolds had little or no place in practical hydraulics. But emphasis given to problems of fluid dynamics by the development of the aeroplane, plus the work of such courageous innovators as Bakhmeteff, have resulted in opening new avenues of advance in hydraulic science.

In his laboratory at Columbia he has pioneered in the study of open-channel and varied flow and has in progress studies of flow in granular media which promise to disclose basic factors and relationships which have long eluded other investigators. He brings to such studies not only a remarkable knowledge of world-wide past and current investigations in his field but a viewpoint and vision, a fertility of imagination, which is constantly uncovering new and productive ideas for continued research and study.

Still another side of his character is his interest in the gracious art of living. He is himself blessed with considerable musical ability, but he takes special interest and delight in all forms of art. The Bakhmeteff apartment in New York City is like a gallery, with examples from well-known artists, in connection with which he tells delightful anecdotes. Of course his pictures include a generous number from Russia. He enjoys describing the origin and significance of his many Russian ikons.

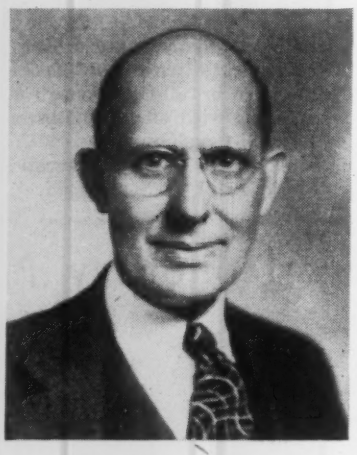
Personally, he is a delightful companion, as might be anticipated from his diplomatic background. He is widely traveled, and widely read. Among hydraulicians he is recognized as an authority in the field of flowing water. As an author, too, he is well known. His books include *Lectures on Hydraulics* (1912), *Varied Flow of Liquids* (1914), *Hydraulics of Open Channels* (1932), and *Mechanics of Turbulence* (1936). His contributions to periodicals, especially those of the ASCE, have been generous.

Speaking of the Society, Dr. Bakhmeteff has taken a considerable interest in it since he became a member in 1917. He won the James Laurie Prize in 1937, and the J. C. Stevens Award in 1944. In the Hydraulics Division he has been active as a member of the executive committee since 1939, and as chairman of the Division since 1942. He now represents the Society on the Council of the American Association for the Advancement of Science. His most recent interest is the National Science Research Foundation (See CIVIL ENGINEERING for November 1945, pages 572–574), bills for the founding of which are now pending in the Senate. He is chairman of a special panel, made up of representatives of the four Founder Societies plus the American Institute of Chemical Engineers, which is working on this measure.

CHARLES FRANKLIN KETTERING

A FARM BOY, a country school teacher at nineteen, a laborer on a telephone line gang at twenty-four, Charles Franklin Kettering is now vice-president and director of the General Motors Corporation and general manager of the General Motors Research Laboratories. He thus embodies to an unusual degree the American ideal of great success through individual effort and ability.

He was born near Loudonville, Ohio, in 1876. The first money he earned, fourteen dollars for cutting a neighbor's wheat crop, was spent on a telephone purchased from a mail-order house, which he promptly dismantled to find out how it worked. After graduating from the local high school he taught in a one-room school house at Bunker Hill, Ohio, until he could realize his ambition of going to college.



CHARLES F. KETTERING
New Honorary Member

In the summer of 1896 he enrolled at the University of Wooster to study the classical languages but soon decided to shift to Ohio State University when he learned of the electrical engineering courses offered there. Before he could enter, however, his eyes failed from overstudy and he was obliged to go back to school teaching. Another effort to attend the University in 1898 also was interrupted by eye trouble, and 1900 found him working as a laborer on a telephone-line gang. That fall he installed in the Star Telephone Company's exchange in Ashland one of the first central-battery systems in Ohio. The next fall he returned to college and, supporting himself by working as a telephone trouble-shooter in his spare time, he graduated in 1904 at the age of twenty-eight. He is supposed to have thrown away his diploma because he did not want to think his education was finished.

Immediately Kettering became associated with the Inventions Department of the National Cash Register Company in Dayton, for which he produced his first electric cash register in 1904, despite prophecies that it could not be done. Today the electric cash register is essentially unchanged from his original model.

In 1909 Kettering left the National Cash Register Company to organize his own laboratory, the Dayton Engineering Laboratories Company, later abbreviated to "Delco." Among the first problems to which he and his partner, Edward A. Deeds, turned their attention was the automobile ignition system, and within a year his electrical starting, lighting and ignition system was an established fact. Despite the outspoken criticism of certain technical men, public acceptance of the self-starter was instantaneous.

His next accomplishment was the invention of an independent electric generator for use in isolated farm houses, schools, and such, which could not be served by central-station power. The result was the Delco Farm Lighting System, placed on the market in 1914. In 1916 Kettering and Deeds sold their interest in the Delco starting, lighting and ignition system to the United Motors Company, later part of General Motors. They then established the Dayton Research Laboratories to work on various problems.

Among Kettering's outstanding contributions at this time was the ignition system for the Liberty engine and the discovery that, for a given fuel, the tendency of an engine to knock increased as the compression ratio was increased. This marked the beginning of the study of anti-knock fuels, resulting in the discovery of tetra-ethyl lead in 1921. In 1920, the new laboratories were taken over by General Motors and in 1925 were moved to Detroit, where they were combined with other research operations as the General Motors Research Laboratories. This organization still functions under Kettering's supervision. Since 1920 Kettering's activities have been so closely allied with those of the General Motors Research Laboratories that it is difficult to separate the one from the other. Kettering believes that research should be a cooperative enterprise involving the integrated talents of all sorts of engineers.

Inventions and discoveries that have come out of his organization include tetra-ethyl lead, a family of new refrigerants, four-wheel brakes, variable-speed transmissions, double glass windows. A more recent contribution is the two-cycle Diesel engine, used in stream-lined trains, submarines, and many other fields both for war and peace. Another important contribution to the war effort was improved means of producing and utilizing high-octane fuels. Immediately after Pearl Harbor, the Laboratories were placed on a full wartime basis, with over 95% of their facilities engaged on projects for the Navy or Army.

Kettering's widespread activities include the C. F. Kettering Foundation for the Study of Chlorophyll and Photosynthesis and the Fever Therapy Research Project at the Miami Valley Hospital in Dayton. When World War II broke out in Europe, the U.S. Government enlisted his talents to assist the armed services in developing weapons of mechanized warfare. In August 1940 the Secretary of Commerce established the National Inventors Council as a government clearing house for inventions of value to defense, and Kettering was appointed chairman. A surprisingly large part of the 16,000 communications received proved to have merit.

Besides his affiliation with many industrial corporations, Mr. Kettering is a trustee of Antioch College and Ohio State University, and part donor of the home of the Engineers' Club of Dayton and one of the Club's founders. He holds membership in a large number of professional and scientific organizations, including the American Academy of Political and Social Science, American Association for the Advancement of Science, American Geographical Society, American Museum of Natural History, American National Red Cross, American Social Hygiene Association, American Physical Society, American Philosophical Society, National Academy of Science, National Child Labor Association, New York Museum of Science and Industry, Newcomen Society. He has been elected a Fellow of the National Academy of Sciences and an Honorary Fellow of Leland Stanford Junior University. Since 1929 he has received honorary degrees from twelve different educational institutions. Other honors include the Sullivant Medal, the Washington Award, the John Scott Memorial Award, the Franklin Gold Medal, the French Legion of Honor, and the Modern Pioneers plaque. His affiliation with the Society dates from 1937, when he became a Member.

CHARLES HENRY PURCELL

DIRECTOR of Public Works for the State of California, Charles Henry Purcell is an eminent civil engineer specializing in the highway and bridge field. A Midwesterner by birth, he attended grade and high school in North Bend, Nebr., then attended Stanford University, and received his C.E. degree from the University of Nebraska in 1906.

Following college, he became resident engineer for the Union Pacific Railroad in Wyoming for about a year. His next work was with the American Smelting and Refining Company at Ely, Nev., as structural design engineer, a position he held until 1909, when he became assistant chief engineer on smelting and power development with the Cerro de Pasco Company of New York and Peru.

CHARLES H. PURCELL
New Honorary Member

Nineteen eleven found him in Marysville, Calif., designing structural parts for gold dredgers for the Yuba Construction Company. From there he went to Cape Horn, Wash., as chief engineer with the Washington Northern Railroad. The following year, 1912, he entered the bridge engineering field by becoming bridge engineer for the Oregon State Highway Department. He held this position until 1917 except for a time when he was bridge engineer of Multnomah County, Oregon, engaged especially to design and construct Columbia River Highway bridges.

His next large assignment was with the U.S. Bureau of Public Roads in Oregon, where he served for two years as bridge engineer, and for the following nine years as district engineer. His connection with the U.S. Bureau of Public Roads terminated in 1928 when he entered the service of the State of California. There he has been ever since in various capacities.

Until 1942 his title was State Highway Engineer, Division of Highways, State of California. In 1929 he was appointed secretary of the Hoover-Young Commission, the purpose of which was to make a survey and prepare preliminary plans and designs for the proposed San Francisco–Oakland Bay Bridge. It also made a traffic survey and design for this bridge in 1931. Since that year Mr. Purcell has also held the title of Chief Engineer of the San Francisco–Oakland Bay Bridge.

This seventy-million-dollar structure was designed to connect San Francisco with its sister cities across San Francisco Bay. Its length, its height above water, the depth of its piers, and the length of its twin suspension spans across the two miles of water between San Francisco and Yerba Buena Island, all make it a remarkable engineering feat. The work, financed by the aid of funds secured through the Reconstruction Finance Corporation, was begun in July 1933. An event of unusual importance in the engineering world occurred on November 12, 1936, when this monumental structure was dedicated and opened to traffic, which flowed smoothly over the 5-mile length of continuous double-deck structures which make up the bridge as a whole.

It is significant as to the quality of this structure and a tribute to its designers, that the "Bay Bridge" has been a conspicuous business success. Estimates of traffic and income were reasonable and the operation of the structure has been sensible, with the result that continuously the tolls have been decreased and the traffic has increased. A distinct compliment to its success is the recent activity looking toward a second and parallel structure.

Since 1943 Mr. Purcell's official title has been Director of Public Works, State of California. His was a merit appointment, most gratifying to him of course, but in addition a compliment to all engineers. He is also ex-officio member and chairman of the California Highway Commission, ex-officio member and chairman of the State Reconstruction and Reemployment Commission, and the same for the Water Project Authority of California. In addition he is an ex-officio member of the Governor's Council and of the California Toll Bridge Authority (of which he has also been secretary since 1943).

On a national and international scale he is also well known. He is a member of the executive committee of the American Association of State Highway Officials and served as president of the organization in 1938. He is a representative of the United States on the Permanent International Commission of the Permanent International Association of Road Congresses, and in 1937 was appointed by Secretary of Agriculture Henry Wallace as a member of the Special Committee for the Consideration of Administrative and Design Policies for Highways. Also in 1937, and through 1939, he served as executive officer of the California Commission for the Golden Gate International Exposition. In 1941 he was appointed a member of the National Interregional Highway Committee, and in 1944 he received the George S. Bartlett Award for distinguished service to the highway industry. In 1936 he received the honorary degree of doctor of engineering from the University of Nebraska, and in 1937 that of doctor of laws from the University of California.

For many years Mr. Purcell has been connected with the Society. He became an Associate Member in 1916 and a Member in 1943. He has made contributions to the publications of the Society—both PROCEEDINGS and CIVIL ENGINEERING.

Interests of Juniors and Students to Be Served by New Staff Member

A RECENT addition to the staff has been made to intensify the service of the Society to younger members and potential members. Harrison D. Comins, Assoc. M. ASCE, has taken this post as an Assistant to the Secretary. In the twelve years since he received his master's degree at Lehigh, Mr. Comins has had a variety of experience that has given him insight into problems common to engineers during the early years of their careers. He has worked on construction jobs in capacities ranging from rodman to resident engineer. He has served industry both as draftsman and as research engineer. He has taught—at the University of Missouri—and he has trained—for the Rock Island District, U.S. Engineers.

The assignment with the U.S. Engineers is the one he is leaving to take up his work on the Society's staff. While at Rock Island, Ill., he set up a training program for civilian employees, selected instructors, and supervised the operation of the program. He has also evidenced a vital interest in the professional growth of his contemporaries. Mr. Comins adds to the staff a young man's viewpoint.

Chairman Reports at Thirteenth Annual Meeting of ECPD

Abstracted from Report of Everett S. Lee, Presented at Dinner Meeting in New York on October 8, 1945

AT THE CLOSE of another ECPD year, I am glad to report substantial progress. Our members have been active, our committees have continued to advance their responsibilities, our opportunities have become appreciated, and our objectives continue to be those to which the engineering profession subscribes, that is:

To coordinate and promote efforts to attain higher standards of education and practice, greater solidarity of the engineering profession, and greater effectiveness in dealing with technical, economic, and social problems.

An immediate objective, now apparently practicable of attainment, is the development of a system whereby the progress of the young engineer toward professional standing can be recognized by the public, by the profession, and by the man himself, through the development of technical and other qualifications which will enable him to meet minimum professional standards.

To attain these objectives we work through our four standing committees. Through these committees the boy who would become an engineer is found in the high school (Committee on Student Selection and Guidance), is carried through his college life (Committee on Engineering Schools, Committee on Professional Training), and into his junior engineering life, say up to ten years after graduation from college (Committee on Professional Training), and thereafter throughout his engineering life (Committee on Professional Recognition) to form a logical sequence of participation.

STANDING COMMITTEES OF ECPD

The Committee on Student Selection and Guidance reports to ECPD means for the educational and vocational opportunities of engineers in order that only those may seek entrance to the profession who have the high quality, aptitude, and capacity required of its members. To this end, the Committee reports this year the continuance of the research work under Dr. W. K. Vaughn of the Carnegie Foundation, on the Pre-Engineering Inventory whereby students entering the freshman year of our engineering colleges can be tested as to their fitness for the engineering courses. The past year has added 4,889 students tested, to give a total of 13,982 tested in 25 engineering schools. The general characteristics of the engineering students presented in this report have significance. Preliminary study of test results indicates that many of these factors bear directly on the success of individual students in the colleges of engineering. As we learn more about these factors and are able to relate them to student ability and accomplishments, examination techniques and guidance functions can be greatly strengthened.

The Committee further reports continued guidance work, mainly this year with service men. Agencies for helping and guiding the service man have been set up in localities throughout our land. The committee has circulated high schools with appropriate pamphlets, and approximately 23,000 copies of *Engineering as a Career* have been circulated this year.

And do not think, fellow engineers, that there is a surplus of engineers. There is, on the contrary, a mighty deficit. The Committee estimates that the need for engineers is such that while in normal years 25,000 freshmen would enter engineering colleges, to meet present needs 65,000 freshmen would have to enter this year. The need for selection and guidance under these conditions is greater than ever.

ACCREDITING ACTIVITIES

The Committee on Engineering Schools reports to ECPD on means for bringing about cooperation between the engineering profession and the engineering schools. In this committee is centered the accrediting activity of ECPD. During the war years inspections of engineering curricula have been held to a minimum, as the committee has believed that engineering colleges could not be fairly judged while operating under war conditions. Even so, during the past three years, 22 curricula at 13 institutions were investigated and special consideration given to 26 curricula at other institutions. With the resumption of normal activities, the normal accrediting program will be resumed.

This year has seen the active setting up of a complete accrediting regional committee personnel covering our entire country, under the Subcommittee on Technical Institutes for the accrediting of technical institute curricula. The days to come will see the beginning of technical institute accrediting under the same guiding principles which have made collegiate accrediting an outstanding contribution of ECPD, and so recognized.

The Committee on Professional Training reports to ECPD plans for the further personal and professional development of young engineering graduates and also of those without formal scholastic training. And to this end the Committee has visualized the *Manual for Junior Engineers* which would state the aims and objectives of the profession and would be in the hands of the professor, the student, the young engineer, the employer, and the older engineer alike. The *Manual* is still in the writing but we hope for its early completion. A continuation of the upkeep of the *Reading List for Junior Engineers* is an important objective of the Committee and this work is progressing.

The Committee on Professional Recognition reports to ECPD methods whereby those engineers who have met suitable standards may receive corresponding professional recognition. This work is necessarily among the engineers who have advanced in the profession and great responsibility rests with them in bringing into being those concepts of the engineering profession which they seek. The Committee suggests several projects. It would be good if the local engineering societies and councils would take some time to discuss these and send their thoughts to Chairman Dougherty for the Committee on Professional Recognition to codify. Such a step would be most constructive. I especially and specifically bring this subject to your attention.

SPECIAL COMMITTEES OF ECPD

The special committees of ECPD are now four in number. The Committee on Principles of Engineering Ethics, under the chairmanship of Dr. Dugald C. Jackson, M. ASCE, is coming closer to an all-inclusive statement. The "Faith of the Engineer," presented by the committee, has been received widely and with sincere appreciation. The Committee on Employment Conditions for Engineers, under the chairmanship of Van Tuyl Boughton [M. ASCE], continues to report the actions in this field. The Committee on Information, this year under the chairmanship of George A. Stetson, continues to give us good publicity, and at present the committee is progressing a listing of the many engineering societies and groups for the Engineers' Joint Council. The Committee on Ways and Means, identical in membership with the Executive Committee, has, as the Executive Committee, progressed its responsibilities as to the finances of ECPD, which we feel are good. Study is being given to future opportunities and how these may be best progressed.

OPPORTUNITY FOR PARTICIPATION OF LOCAL ENGINEERING SOCIETIES AND COUNCILS

Last year we circulated the Twelfth Annual Report of ECPD to some 75 local engineering society groups throughout the land, and with it sent copies of the ECPD "Will You Help?" pamphlet. Also a letter calling attention to the opportunities for local chapters, sections, and branches of the eight participating bodies of ECPD together with other local engineering organizations and interested groups to participate in the ECPD program, specifically through the four standing committees of ECPD and through the special committees as opportunity offered. The response to our letters has been most substantial in interest, and we have supplied in return upon request many more of the ECPD "Will You Help?" pamphlets and a considerable amount of ECPD literature.

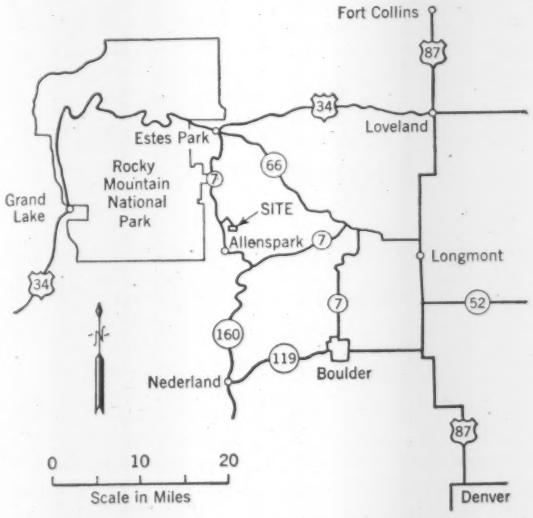
Specifically, there is the opportunity for selection and guidance work in the high schools under the auspices of the Committee on Student Selection and Guidance. Then there is the opportunity for engineering school interest participation through the Committee on Engineering Schools. Then there is the opportunity for working with the junior engineer as he is leaving college and entering his life engineering work, and we are hopeful for our Manual as a great aid here. And last, there is that ever-present opportunity for the local engineering society groups of the land to bring to the Committee on Professional Recognition their thoughts and suggestions and plans for the future of the engineering profession, within the charter of ECPD.

Hydraulic Laboratory Established

AN EXCELLENT site in the Rockies has been chosen for the establishment of a summer hydraulic laboratory as a service to the entire profession. To be known as the Rocky Mountain Hydraulic Laboratory, the facilities are being provided by a non-profit corporation organized under the laws of the State of Colorado.

The location on North St. Vrain Creek, near Allenspark, Colo. (see accompanying map), has been acquired as the first step in readying facilities for the engineers, hydraulics teachers, and students who may wish to spend their summer vacations working on some of the fundamental problems that are in need of experimental solution or verification. The site is near the Rocky Mountain National Park, and several hotels and a variety of rental cabins are available within walking distance. The discharge of the creek is many times that ordinarily used in hydraulic experiments, and it has nearly 80 ft of fall in the quarter-mile of its length within the 20-acre site. All the water will be returned to the stream so as not to interfere with established water rights.

Use of the laboratory's facilities will be open, upon registration and payment of fees, to all qualified persons. It is expected that the charges can be kept low, for there will be no pumping costs, and only a minimum amount of housing is necessary since the dry



LOCATION MAP OF HYDRAULIC LABORATORY IN COLORADO

summer climate is ideal for outside work. The laboratory will not grant academic credit or certify to attainments, but individual staff members are at liberty to do so on their own responsibility. The staff for the summer of 1946 has not yet been announced.

Trustees of the non-profit corporation which owns the site and which will operate the laboratory are the following: Gerard H. Matthes, John L. Savage, and Sherman M. Woodward, Honorary Members ASCE; J. C. Stevens, President ASCE; Hardy Cross, Francis M. Dawson, Ivan E. Houk, Adolph F. Meyer, C. J. Posey, Edward Soucek, and Royce J. Tipton, members ASCE; and Clifford H. Stone. Mr. Matthes has been elected president and Ralph W. Powell, M. ASCE, secretary, while Professor Posey has been designated to serve as director and treasurer.

According to the by-laws, adopted by the trustees, "Any member in good standing of the Hydraulics Division of the Society, shall, if he desires, be considered to be a member of the corporation, and entitled to all the privileges of membership, including the right to attend meetings and that of joining with other members in making nominations for trustees."

Draft Exemptions—But Late

APPARENTLY the United States was the only active participant in World War II which failed to make any provision in its military draft laws to exempt students or teachers in engineering and scientific fields. For the past three years or more the Society, and other organizations with similar objectives, have battled vigorously against this short-sighted policy. Toward the end of November 1945 Selective Service headquarters announced that hereafter, during the life of Selective Service, exemptions will be granted to certain persons in engineering and scientific fields.

Included in the provisions for exemption are:

1. Candidates for master's or doctor's degree in the physical sciences or engineering.
2. University teachers in physical science or engineering.
3. University research workers in the physical sciences or engineering.
4. Students preparing for a B.S. or B.A. degree in the physical sciences or engineering, provided they have "served for a period of not less than two years in a project directly connected with the war effort."

Applicants for exemption under this ruling will be examined in an effort to make sure they are qualified bona fide members of at least one of the groups listed.

National Council of Engineering Examiners Outlines Program

IN THE DECEMBER issue of "The Registration Bulletin," an expanded future program of service was announced by H. T. Person, M. ASCE, president of the National Council of State Boards of Engineering Examiners. With this program the Council aims to "provide for larger and more definite services and a strengthening of our present activities."

A three-year plan of activities will be supported by a 1946 budget of $10,000, increased to $14,000 in 1947 and to $17,000 in 1948. Services of a full-time executive secretary will be employed, with T. Keith Legaré, M. ASCE, in that post. As can be gathered from its name, the organization is concerned primarily with the administration of state registration laws and the strengthening of the "registration movement." It has recently celebrated its twenty-fifth anniversary.

The National Council is supported by fifty state and territorial boards of engineering examiners and by national and state engineering societies. Among the latter are three of the four Founder Societies. The annual appropriation of the ASCE is $500.

Civil Engineer Wins Alfred Noble Prize

AS PREVIOUSLY announced, this year the Alfred Noble Prize goes to a civil engineer—August L. Ahlf, Jun. ASCE, for his paper, "Design Constants for Beams with Non-Symmetrical Straight Haunches," which appeared in the 1944 issue of PROCEEDINGS. The prize will be presented at the Annual Meeting of the Society in January.

AUGUST L. AHLF
Winner of Alfred Noble Prize

Mr. Ahlf was born in Ogden, Utah, on August 12, 1911, and graduated from the University of Utah in 1934, receiving the degree of bachelor of science in civil engineering with high honors. He then took postgraduate courses at Utah State Agricultural College and the University of Colorado, receiving the degree of master of science from the latter institution in 1939.

Since 1936 Mr. Ahlf has been employed as an engineer in the Branch of Design and Construction of the U.S. Bureau of Reclamation at Denver, Colo., in the design and preparation of specification and construction drawings for reclamation projects, principally on the Boulder Canyon and Central Valley projects. Recently he received an award from the Bureau for the preparation of design charts for the solution of design problems involving wooden stop planks.

Society Staff Strengthened by Return of Capt. Carl E. Beam

THE STAFF at Headquarters early in December welcomed back Capt. Carl E. Beam, formerly Assistant Secretary of the Society. In May 1941 he left for service with the Navy's Bureau of Yards and Docks in Washington, D.C., as a Lieutenant Commander. During his four years with the Navy, he rose to the rank of Captain, and served on that Bureau's Board for Contract Awards.

CAPT. CARL E. BEAM LEAVES NAVY TO RETURN TO SOCIETY STAFF

Before he was called to active service, Mr. Beam had been on the staff of the Society for twenty years—longer than any other member of the technical staff. In that time he had handled practically every phase of Society affairs, including publications, Technical Division administration, and meetings. Numerous studies of Society effectiveness were carried out under his direction, and for the same fact-finding purposes he served on various boards as the Society's representative.

A wide circle of friends and acquaintances welcomes Captain Beam back to Society work, and it is expected that his energies will stimulate renewed activity in certain phases of the professional endeavor of Society groups.

Illinois Section Cooperates in Power Conference

AFTER a year's lapse due to the war, the Midwest Power Conference will again be held in Chicago in April 1946 under the sponsorship of the Illinois Institute of Technology. Canceled in 1945 because of government regulations, this conference is annually the largest meeting of its kind in the nation. The 1946 meeting has been enlarged to three full days, April 3, 4, and 5, with headquarters at the Palmer House.

Preliminary plans include for the first time a session on the gas turbine, which has assumed an increasingly important position in recent years owing largely to wartime developments. Applications of atomic energy in the postwar power world will also be discussed. Other scheduled sessions include papers on industrial power plants, hydro power, feedwater treatment, recent developments in the fields of heating and air conditioning, fuels and combustion, central station practice, industrial loads supply, diesel power, insulation problems on power systems, and recent electrical developments.

Chief highlights of the three-day session will be an "All-Engineers" dinner, and joint luncheons with the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

Cooperating with the Illinois Institute of Technology in the sponsorship of the 1946 conference are nine midwestern colleges and universities and several engineering societies. The former group is composed of the University of Illinois, University of Michigan, University of Minnesota, University of Wisconsin, Northwestern University, Purdue University, State University of Iowa, Iowa State College, and Michigan State College. The eight engineering groups are the Chicago Section, A.I.Ch.E.; Chicago Section, A.I.E.E.; Chicago Section. A.I.M.E.; Chicago Section, A.S.M.E.; Illinois Section, ASCE; Illinois Chapter, A.S.H. and V.E.; the Western Society of Engineers; and the Engineers' Society of Milwaukee.

Survey of Technical Division Membership

Action was taken instructing Society Headquarters to make a survey and an appraisal of the activities of Technical Divisions at the October meeting of the Board of Direction. The Board directed, as part of the study, that the membership be polled with respect to its preferences regarding Technical Division affiliation.

Enclosed with the bills for 1946 dues, Technical Division selection cards have been sent to members. These are to be marked indicating by numeral the order of preference of Technical Division affiliation. Selection is to be limited to three Divisions.

These cards should be returned by January 31. Except for those in distant locations, non-return of the card by January 31 will be considered as indicating no desire for Division affiliation.

If any member has failed to receive a Technical Division selection card, he may indicate his preference by writing to Headquarters. The list of Technical Divisions follows, and it should be noted that a new Division, the Air Transport Division, has been authorized.

City Planning
Construction
Engineering Economics
Highway
Hydraulics
Irrigation
Power
Sanitary
Soil Mechanics and Foundations
Structural
Surveying and Mapping
Waterways
Air Transport

C. Glenn Cappel Wins Construction Engineering Prize

AS ANNOUNCED in the December issue, the Construction Engineering Prize goes to C. Glenn Cappel, M. ASCE, for his paper on "Timber Hangar Erected from 16-Story Scaffold," which appeared in the December 1944 issue of CIVIL ENGINEERING. Although the Construction Engineering Prize is awarded on advice of the Construction Division, it is different from the other Division prizes in that it is the only award specifically limited to material appearing in CIVIL ENGINEERING.

C. GLENN CAPPEL
Recipient of Construction Prize

Born in Marksville, La., on June 21, 1892, Mr. Cappel graduated from Louisiana State University in 1912, and then went to Rensselaer Polytechnic Institute for postgraduate work. From 1914 through 1917 he was with the Louisiana Highway Department, first as resident engineer and then as bridge engineer. And during the first World War he was chief inspector on construction of the New Orleans Army Supply Base. In 1920 he went to Mexico for Doullut and Williams Company, Inc., in the capacity of assistant general manager and chief engineer on a large terminal project. Returning to this country in 1921, he was manager of the building department of Doullut and Williams until the dissolution of that firm in 1924. He then became vice-president of the W. Horace Williams Company, which was organized upon the dissolution of Doullut and Williams. The W. Horace Williams Company changed its firm from corporation to partnership in 1940, and Mr. Cappel is now a member of the firm.

During the recent war Mr. Cappel was in direct charge for the company of both Army and Navy projects, including Camp Claiborne, Camp Polk, the Belle Chasse Ammunition Depot, and the Naval Air Station (LTA) at Houma, La.

Presentation of the prize, which was established in 1939 by A. P. Greensfelder, M. ASCE, will take place at the time of the Annual Meeting in January.

Next Yearbook—1947

THE SOCIETY'S Yearbook has been issued annually, with the most recent revisions available, making it a reference book as to officers, organization, and membership. The membership data have been in two groups—a main or alphabetical list and, except for the past two years, a secondary or geographical list. Publication of the Yearbook has required special operations in the Headquarters office and special printing. Issuance ordinarily has been with the April PROCEEDINGS as a separate volume.

To meet the April mailing date, the membership address records were closed at the end of January. Even in normal times the result of this lag was that some of the personal data shown were obsolete. The present rate of address changes in the Society is about one thousand a month. This abnormally high rate is due to the return of servicemen and the movement of engineers formerly with war plants. Complicating this problem of rapidly changing addresses was the possibility that a 1946 Yearbook might not be delivered before May. In any event a good part of the year would have passed before members received the Yearbook and by that time thousands of the addresses in it would be incorrect.

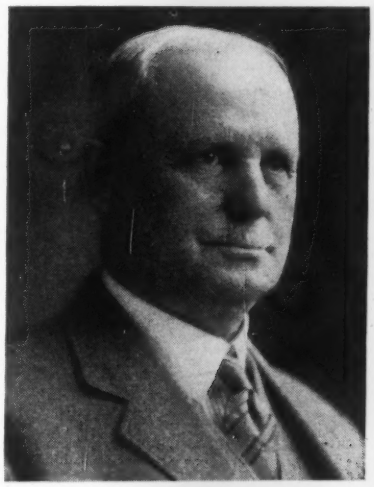
Because of these considerations and the fact that production of the Yearbook would cost in excess of $16,000, the Executive Committee decided to skip the 1946 issue. Instead, a partial issue of about 50 pages will be printed as a 1946 supplement to the 1945 Yearbook. This supplement or insert will cover 1946 information as it would normally appear in the first part of a regular Yearbook. The insert will be mailed in February.

In addition to the 1946 Yearbook insert, the secretary of each ASCE Local Section will receive, next February, a list of names and addresses of members assigned to his Section as of January 1946. The name and address of each Section Secretary will also be carried in the 1946 Yearbook insert.

A complete Yearbook will be issued in 1947. It will contain a geographic listing of members and several other regular features which were omitted during the war years of paper shortage. Procedures regarding the recording of changes of address and other arrangements looking toward the issuance of the regular Yearbook earlier in the year than formerly, are being worked out. For 1946, however, members should retain their 1945 Yearbook.

Honorary Member Frank Gilbert Jonah Is Dead

IN the death of Frank Gilbert Jonah, which took place in St. Louis, Mo., on December 7, 1945, the Society has lost one of its most distinguished members. Long a member of the Society, Colonel Jonah served a term as Director in 1916 and 1917, and as Vice-President in 1933 and 1934. He was elected Honorary Member in 1940.



FRANK GILBERT JONAH, 1864–1945

A native of Canada—he was born in New Brunswick in 1864—Colonel Jonah was educated in that country and spent his early engineering career there. He came to the United States in 1890 and settled in St. Louis in the capacity of assistant engineer on the St. Louis Merchants Bridge Terminal. His major work was with the St. Louis San Francisco Railway, with which he was connected from 1901 until his retirement a few years ago. He became chief engineer of construction in 1910 and chief engineer of the entire system in 1913. In the latter capacity he had charge of the important work of reconstruction done by the railroad in central Missouri, and the linking and rebuilding of Southern lines, one of them extending to Pensacola, Fla.

His record in the first World War was notable, as he was largely responsible for recruiting the 12th Engineers, a voluntary regiment of railroad workers organized in St. Louis. Going overseas with this regiment as major, he later planned most of the light railways built by the American Army to connect the front lines with the standard-gage tracks. At the time of his discharge in 1919 he had attained the rank of lieutenant colonel, and he received several decorations for his services.

Charles Adkins Baker, Society Counsel, Dies

SERVICES of many years as legal counsel for the Society were concluded when Charles Adkins Baker died on December 7, 1945. He had been for years head of Parker and Aaron, an old established law firm in New York City.

For a number of decades the Society has looked to this firm for its legal advice. It was while the Society's Headquarters were still at its West 57th Street address that the firm was first called into consultation. So successful were the business arrangements that the commitment continued from year to year, even following the death of both Messrs. Parker and Aaron. Similarly, other organizations of an engineering nature, notably the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, as well as the United Engineering Trustees, retained the services of this firm.

As he succeeded to this professional relationship, Mr. Baker made a considerable study of the corporate setup of the organization and was an authority to whom Society officers continually turned for advice. He was a lawyer of the old school, who held a great respect for the Society. Relations were always mutually appreciated and it is therefore with great regret that his death at the age of 67 is now recorded.

Five Student Chapters Again Active

SIGNIFYING increased enrollments in civil engineering college courses, five Student Chapter officers have recently notified Headquarters of intent to resume an active program. This indication is encouraging for in recent years 41 colleges found they had so few full-time students enrolled that a Student Chapter of ASCE could not maintain a program.

The Chapters recently reactivated are Carnegie Institute of Technology, The Citadel, Montana State College, Ohio State College, and Vanderbilt University. In each case the request to resume affiliation has followed spontaneous desire to present an active pre-professional program to students interested in development in their chosen field. The formalities of such a reaffiliation are very simple, consisting primarily of an exchange of notes indicating and acknowledging intent to present an active program.

Among the advantages of Student Chapter organization are access to the Society's library of films and slides and illustrated lectures, contact with the professional civil engineers in the area through joint activities with Local Sections, access to the publications of the Society, and preparation for individual affiliation with the Society upon graduation from college. At the present time there are 90 active Student Chapters in the nation with nearly 2,000 members.

The Engineer in Foreign Service

XXVI. Aboard the "Lowry" in the Pacific

By PAUL J. FORD, Assoc. M. ASCE
LIEUTENANT (JG), U.S. NAVAL RESERVE

FOR THE LAST four months I have been particularly busy, having participated in the Okinawa campaign since its inception. The *Lowry* was with the small carriers from March 24 to April 30, at which time we were assigned as radar picket ship and stayed on that duty until June 28.

It is our belief that our ship had the longest tour of picket duty of any destroyer at Okinawa. We were lucky enough to come out with only two fatal casualities and only minor damage to the ship.

We had many encounters with the "Zoomies," as the fanatical little sons of (heaven?), who tried to join their ancestors and take us with them, were called in this area.

We were in company with the *Drexler* (the picket ships always traveled in pairs) on the morning of May 28 when she was sunk in four minutes, having been hit by two twin-engined Japanese bombers in succession. Two of the same type had picked on us at the same time, but we were lucky enough, or our gunners were good enough, depending on the point of view, to knock them down. There were ten planes in this one attack but the *Lowry*-controlled combat air patrol got the rest of them before they could get in to us.

We have been hit only once, which was on May 4, when we were under attack by four Japanese fighter planes. We managed with the help of the destroyer with us to shoot down three of them, but the fourth one got in. Fortunately he was on fire and out of control, and winged over just as he hit our after 5-in. gun mount, making contact with only one wing. The rest of the plane with its bomb catapulted across the ship and exploded in the water on the port side. The side of the ship was riddled with fragments, and it was at this time that we suffered our two fatal casualties, along with 35 others wounded. We also had a small fire amidships, which was quickly extinguished.

On another occasion, I believe it was on the night of June 28, on our last picket station, we were under a night attack during the brightest moonlight I have ever seen anywhere. The planes had come in only once, and had been driven off, when there occurred a full eclipse of the moon, which left the night pitch black. We were able to shoot down one plane with the use of our fire control radar, and after about two hours, just as the eclipse was waning, the planes were driven off by Marine night fighters. Events like the above are reasons why we call ourselves "The Lucky Lowry."

We were also in the first resupply group to Mindoro, where we were under eight separate air attacks. Lingayen Gulf was our next encounter, at which time we knocked down one plane and participated in the preliminary shore bombardment. Then, on the first carrier strike on Tokyo, the *Lowry* was part of the screen for the carriers, but the Japs couldn't find us or else they didn't want to find us, I don't know which. At any rate, we didn't see a thing except a lot of rough water.

The *Lowry* has been detailed to stay out here a little longer to help maintain surveillance of the waters around Japan and to support the occupation.

It was one of my biggest disappointments that the Naval Civil Engineer Corps was not taking any more commissions at the time I joined the Navy. However, now that I have been a line officer on a destroyer I know that I have had an experience that I will be proud to remember, although there were times when I would have given nearly anything to be out of it.

My only desire now is to get back to my wife and my ten-month-old son (whom I haven't yet seen), and get back into engineering work. I hope that it won't take too long to catch up with all the progress that has been made while I have been gone. Right now about all I can remember is $Mc = SI$.

J. Waldo Smith Fellowship to Be Resumed

UNDER Society sponsorship a Fellowship established through the generosity of the late J. Waldo Smith, Honorary Member, and named for him, is now open for award. The objective of this fund is to promote research in the field of experimental hydraulics. During the war operation has been in abeyance but now the award is to be reopened for competition. Applications are the joint responsibility of the candidate and the institution in which he is to work as a graduate student. Preferably he should be a Junior of the Society. To underwrite this work, a sum of $600 is provided plus as much more, up to $400, as is needed for equipment, which is expected to become the property of the institution upon completion of the research. Further details as to the nature and operation of the J. Waldo Smith Hydraulic Fellowship are found in the current Yearbook, page 93.

This award is expected to become operative for the full year beginning July 1, 1946. The committee in charge has decided upon the following as the problem to be explored: Determine a practical working relation between diameter of pipe, slope of pipe downward in the direction of flow, slope of hydraulic gradient, average velocity of flow, and possibly other variables, and ability of the velocity to carry air bubbles along and prevent accumulation of air at a high point in the line; also to determine the rate of correction or the degree of certainty with which an increased velocity will entrain and remove the air after it is once accumulated. Other suggestions for detailed experimentation will be offered to the successful candidate.

Applications are to be made out in triplicate and submitted to Society Headquarters by April 1. Decision will be reached as soon as possible after May 1, or in time for the proper planning of the summer's work. Other members of the committee, in addition to Chairman Karl R. Kennison, are Charles M. Allen and Roger W. Armstrong, all Members ASCE.

A News Note for "Civil Engineering"

WRITING from Nagoya, Japan, on Pearl Harbor Day, Pfc. Charles E. Schaffner, Jun. ASCE, records that he has "spent quite a lot of time looking over the city. Our bombers really did a terrific job. One practically can count the number of large buildings still standing. Those that weren't bombed were burned out. From what I've seen in Japan, civil engineers will be the busiest men in the country for at least the next decade."

Correct Mailing Addresses Requested

DURING recent months, members of the Society have been moving about at such a rate that it has been impossible to keep mailing addresses of every member up to date. This has resulted in mismailing of correspondence and publications. If you have recently changed your address have you notified ASCE of your new address?

Each member is permitted to have but one mailing address. Duplication is made impractical and costly with the present large number of members. Multiple addresses in the past have also made possible disappointments in late receipt of desired mailings. There will be no change in the method of allocation to Local Sections. As in the past, members will be allocated according to their mailing address.

If your present mailing address is incorrect, please fill out and mail the coupon to be found on page 14 (advertising section) of this issue. A similar coupon will be included in each issue of CIVIL ENGINEERING as long as such practice is warranted.

Appointments of Society Representatives

BORIS A. BAKHMETEFF, Hon. M. ASCE, and GLENN L. PARKER, M. ASCE, have been appointed temporary Society representatives on the Council of the American Association for the Advancement of Science.

F. M. DAWSON, M. ASCE, has been appointed Society representative on American Standards Association Committee A-40 to fill the vacancy caused by the death of W. S. L. CLEVERDON, M. ASCE. He will be alternate representative for CHARLES GILMAN HYDE, M. ASCE.

DEAN G. EDWARDS, M. ASCE, has been appointed to fill the vacancy on the E.C.P.D. Committee on Principles of Engineering Ethics, caused by the resignation of ARTHUR W. DEAN, M. ASCE.

RALPH H. MANN, M. ASCE, chairman; L. D. DRAPER and JOSEPH O. MAY, Members ASCE; and JOHN J. HOGAN, Assoc. M. ASCE, have been appointed as a subcommittee of the American Standards Association Committee Z-14.

GLENN B. WOODRUFF, M. ASCE, has been appointed an additional Society representative on the Column Research Council.

News of Local Sections

Scheduled Meetings

CINCINNATI SECTION—Regular meeting in the Engineering Societies Headquarters on January 9, at 8 p.m.

COLORADO SECTION—Dinner meeting at the Oxford Hotel on January 14, at 6:30 p.m.

CONNECTICUT SECTION—Dinner meeting at the Graduate Club on January 21, at 6:30 p.m.

DAYTON SECTION—Luncheon meeting at the Engineers' Club on January 21, at 12:15 p.m.

FLORIDA SECTION—Dinner meeting at the Seminole Hotel on January 4, at 7 p.m.

GEORGIA SECTION—Luncheon meeting in Davison's Tea Room on January 4, at 12:30 p.m.

KENTUCKY SECTION—Luncheon meeting in the Lafayette Hotel on January 25, at 12 m.

LOS ANGELES SECTION—Dinner meeting at the University Club on January 8, at 6:45 p.m.

LOUISIANA SECTION—Supper meeting at Mr. O. K. Olsen's residence on January 26, at 8 p.m.

MARYLAND SECTION—Dinner meeting at the Engineers' Club on January 23. Cocktails at 6 p.m.; dinner at 7 p.m.; and meeting at 8.

MIAMI SECTION—Dinner meeting in the El Commodoro Hotel on January 3, at 7 p.m.

NORTHWESTERN SECTION—Dinner meeting at the Minnesota Union on February 4, at 6:30 p.m.

PHILADELPHIA SECTION—Technical meeting at the Engineers' Club on January 8, at 7:30 p.m.; the meeting to be preceded by a good fellowship dinner at 6 p.m.

SAN DIEGO SECTION—Dinner meeting at the U.S. Grant Hotel on January 24, at 6:30 p.m.

SACRAMENTO SECTION—Regular luncheon meetings at the Elks Club every Tuesday at 12 m.

ST. LOUIS SECTION—Luncheon meeting at the York Hotel on January 28, at 12:15 p.m.

SOUTH CAROLINA SECTION—Annual meeting at the Columbia Hotel on January 23, at 1 p.m.

SYRACUSE SECTION—Dinner meeting at the Museum of Fine Arts on January 28, at 6 p.m.

TENNESSEE VALLEY SECTION—Dinner meeting of the Knoxville Sub-Section at the S & W Cafeteria on January 9, at 5:45 p.m.

TEXAS SECTION—Luncheon meeting of the Dallas Branch at the Adolphus Hotel on February 4, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel on January 14, at 12:15 p.m.

TRI-CITY SECTION—Dinner meeting at the Fort Armstrong Hotel on January 10, at 6:30 p.m.

Recent Activities

BUFFALO SECTION

At the luncheon meeting held on November 21, Dr. Alexander Schwareman spoke on the discoveries that made the atomic bomb possible. He is director of research for Spencer Kellogg and Sons, Inc. During the business session the annual election of officers was held, the results being as follows: Martin H. Brennan, president; Louis S. Bernstein, vice-president; A. Stuart Collins, secretary; and Harry M. Huy, treasurer.

CINCINNATI SECTION

The November meeting of the Cincinnati Section took the form of a joint session with the local branch of the American Society of Mechanical Engineers and the Engineering Society of Cincinnati. Guest of honor and principal speaker was Dr. Lillian Moller Gilbreth, president of Gilbreth, Inc. A pioneer in work management and the development of motion study, Dr. Gilbreth discussed these subjects most interestingly.

CLEVELAND SECTION

On November 16 members of the Cleveland Section heard A. H. Candee discuss the place of the Diesel locomotive in American railroading. Mr. Candee, who is transportation engineer for the Westinghouse Electric Corporation, stated that railroads built the United States, and that they will have a continuing place in the life of the nation, despite the development of other important forms of transportation. Considerable business discussion preceded the technical session.

COLORADO SECTION

A number of out-of-towners were guests of the Section for their November meeting, which took place in Denver on the 12th. Among these was John H. Gardiner, Director from District 11, who discussed Society affairs and gave a résumé of the Annual Convention. The speaker of the evening was Philip B. Gilliam, judge of the juvenile court, who reminisced concerning his experiences with the juvenile court and as a police court judge.

DAYTON SECTION

The manufacture of contact lenses and their use in the war was the topic of discussion at the November meeting of the Dayton Section, the principal speaker being Roy Marks. Mr. Marks, who is vice-president of the Univis Lens Company, illustrated his talk with moving pictures showing the method of manufacture and how the patient is fitted to the lenses and taught to wear them. Mr. Marks stated that the lenses are a relatively new development, and that the demand for them is far beyond the capacity of the company to fill.

HAWAII SECTION

On October 11 members of the Hawaii Section met to hear Joseph F. Kunesh speak on the subject, "War Problems of the Department of Public Works of the City and County of Honolulu." Mr. Kunesh, who is chief engineer of the Department of Public Works, City and County of Honolulu, covered the situation from the wartime emergency era to the present postwar phases. A general discussion of local engineering problems concluded the program.

ILLINOIS SECTION

A dinner in honor of W. N. Carey, Secretary and Executive Officer of the Society, preceded the November meeting of the Illinois Section. The list of guests for the occasion included Col. H. S. Crocker, Past-President and Honorary Member of the Society. Later in the evening Colonel Carey discussed various aspects of Society affairs. He was followed on the program by Ralph H. Burke, president of the Section, who gave a talk on "The Airport Problem in Chicago." Mr. Burke, who is the engineer member of Mayor Kelly's Airport Selection Board, has played an important part in planning additional air-transportation facilities in the Chicago area, and the group heard him with great interest. Recently the Board has recommended the acquisition of the Douglas Airport site for the city's new airport, and Mr. Burke explained the considerations that led to the selection of this site.

IOWA SECTION

The November meeting of the Iowa Section—held at Des Moines on the 16th—was divided into an afternoon business session and an evening technical meeting. During the first of these sessions, officers for 1946 were elected as follows: E. W. Lane, president; L. W. Mahone, vice-president; and L. O. Stewart, secretary-treasurer. Several committee reports were presented, and Robert Jordan, vice-president of the Iowa State College Student Chapter, described the work of that Chapter. The technical program, presented that evening, consisted of a talk on the development of the Missouri River Basin—given by Col. D. B. Freeman, district engineer for the U. S. Engineer Office at Omaha, Nebr. During the evening a certificate of life membership in the Society was presented to George W. Koss, of Des Moines.

ITHACA SECTION

At the October meeting of the Section the following officers were elected for the ensuing year: Charles L. Walker, president; Leonard L. Huttlestone, first vice-president; Frank L. Bolton second vice-president; and Marvin Bogema, secretary-treasurer (for

three years). The speaker of the evening was Col. E. R. Van Deusen, professor of military science and tactics and commandant at Barton Hall, Cornell University, who discussed "The Human Side of the Army." Another member of the Cornell faculty—L. D. Doty, professor of hydraulic engineering—addressed the November meeting, held at the university on the 29th. His subject was the St. Lawrence Waterway Project, and in the ensuing discussion local objections to the project were clarified.

LEHIGH VALLEY SECTION

The November meeting of the Lehigh Valley Section took place at Lehigh University in Bethlehem on the 12th. The members heard an illustrated lecture on "The Navy Seabees in Action, which was given by Comdr. Irvin S. Rasmusson, Civil Engineer Corps, U.S. Naval Reserve. After explaining the organization of the Seabees, Commander Rasmusson described the accomplishments of the 40th Naval Construction Battalion, which he commanded in action in the South Pacific. Following his talk, two reels of sound motion pictures depicting the activities of the Seabees were shown. A number of Student Chapter members were guests of the Section for the occasion.

LOS ANGELES SECTION

Those attending the October meeting heard talks by Maj. Robert W. Thomas and Leonard Lavall, who recounted their experiences in operations in the Pacific. Major Thomas spent nearly four years overseas. Starting his career as a Coast Artillery officer, he was later transferred to the Corps of Engineers and finished his period of service on airfield construction in Burma and Assam. Major Thomas spoke most interestingly of his experiences in India and discussed the customs of the country. For seventeen months Mr. Lavall was chief carpenter's mate in the Seabees in charge of airports, breakwaters, quarries, and camouflage in the Attu area.

LOUISIANA SECTION

Part of the October meeting of the Louisiana Section was devoted to business discussion. A talk on "Our National Highway Program" comprised the technical program for the occasion. This was given by J. A. Elliott, division engineer for the Public Roads Administration at Dallas, Tex., whose talk stimulated considerable general discussion.

MARYLAND SECTION

On October 18 H. H. Stevens, New York City consultant, addressed a gathering of the Maryland Section. Mr. Stevens' subject was air-supported roofs for large structures, of which he is the originator and designer. Since this type of roof is under consideration for the proposed Baltimore municipal stadium, the talk provoked a very interesting discussion, in which Mr. Stevens took the lead. At the meeting held on November 15, the Section unanimously went on record as opposing the Kilgore Bill and favoring the Magnuson Bill. The scheduled speaker was Don Eugenio de Anzorena, who gave an interesting talk on his home country, Mexico, stressing the good feeling between that country and the United States. He was followed by Maj. Gen. Julian L. Schley, who discussed the International Highway connecting the United States and Mexico City. General Schley is the new executive director of the Baltimore (Md.) Aviation Commission.

METROPOLITAN SECTION

Various aspects of the atomic bomb project were discussed at the November 21 meeting of the Metropolitan Section, the principal speaker being Brig. Gen. Thomas F. Farrell. General Farrell, who is deputy chief of the Manhattan Engineer District (the atomic bomb project) was in the Pacific theater when the bombs were dropped on Hiroshima and Nagasaki, and subsequently inspected these devastated cities. His talk was supplemented by moving pictures of the atomic bomb project.

Members of the Junior Branch were instructed in "Practical Soil Problems" by Col. Carlton S. Proctor on November 28. At the next meeting, which was held on December 12, they heard an address on opportunities for engineers in the New York area. This was given by John C. Riedel, chief engineer for the New York Board of Estimate.

MID-SOUTH SECTION

The application of model landscapes in solving flood control problems was discussed in an illustrated talk by Capt. J. B. Tiffany, Jr., before the October 4 meeting of the Mid-South Section. Captain Tiffany is assistant to the president of the Mississippi River Commission. The meeting was held in Tupelo, Miss., scene of the Mississippi-Alabama State Fair, and the group then attended the fair, viewing the exhibit of the U.S. Geological Survey.

NEBRASKA SECTION

On October 18 there was a joint meeting of the Nebraska Section and the University of Nebraska Student Chapter. The feature of the occasion was a talk by Royce J. Tipton, Director for District 16, who outlined Society trends as reflected in the current Society program, pointing out the constant effort of the Board of Direction to make its activities responsive to the needs and desires of the membership.

NEW MEXICO SECTION

Much of the October meeting of the Section—which took place at the University of New Mexico on the 17th—was given over to business discussion. Later two sound films, illustrating the effect of erosion and silt deposits and suggesting measures for control, were shown. There was, also, a general discussion of irrigation problems and silt control. The speaker at the November 7 meeting was Royce J. Tipton, Denver consultant and Director of the Society. Mr. Tipton gave a résumé of irrigation from earliest historical times down to the present day, pointing out that only a small area of the United States has been irrigated in comparison with the vast irrigation developments in India and China.

NORTHWESTERN SECTION

A symposium on soil mechanics was the feature of the dinner meeting held on November 5. Those taking part were H. S. Loeffler, assistant chief engineer of the Great Northern Railway, who discussed soil problems and the railroads; W. E. King, president of the St. Paul firm of Toltz, King and Day, Inc., whose subject was the practical application of soil principles to foundations; Miles S. Kersten, of the civil engineering department at the University of Minnesota, who explained the use of soil mechanics in the construction of roads, streets, and airport pavements; and C. W. Britzius, chairman of the Soils Committee of the Northwestern Section, who concluded the program with a plea for a better method of soils classification and for soil tests for important engineering structures.

PITTSBURGH SECTION

On November 30 members of the Pittsburgh Section heard Dr. D. B. Steinman, New York City consultant, speak on the subject of "Bridges and Aerodynamics." Dr. Steinman was assisted in his presentation by Ray Boynton, a member of his staff. The meeting was a joint session with the civil section of the Engineers' Society of Western Pennsylvania.

PROVIDENCE SECTION

"American Military Engineering at the Battlefront" was the topic of discussion at the December 6 meeting of the Providence Section. The principal speaker appearing on this program was Waldo G. Bowman, editor of *Engineering News-Record*, who described his experiences as a war correspondent in the European theater. Illustrating his talk with lantern slides, Mr. Bowman described the engineering problems involved in modern methods of warfare. Extremely bad weather cut down the attendance.

PUERTO RICO SECTION

The Puerto Rico Section reports that it has had several interesting meetings in recent months. On October 29, Cesar Canals was the guest speaker, presenting a talk on some of his experiences in the design of large projects in South America. Mr. Canals, who is resident engineer for the Frederick Snare Corporation, of New York, stressed the importance of preliminary investigations and foundation work. On November 21, Carlos M. Passalacqua addressed the group on the general plan of highways in Puerto Rico and its relationship to the economic development of the island.

Mr. Passalacqua is chief planner of the Puerto Rico Planning Board. During the business session the following new officers were elected: John R. De Lacy, president; Felix A. Leon and Miguel A. Fernandez, vice-presidents; and Raoul N. Arroyo, secretary-treasurer.

San Diego Section

The speaker and guest of honor at the October 25 meeting of the San Diego Section was S. O. C. Noren, former U.S. minister to Lithuania and Russia. Mr. Noren discussed relations between the two countries up to the time of the present war. Much of the November 15 meeting was devoted to business discussion. Franklin Thomas, Vice-President of the Society for Zone IV, was present and spoke on Society affairs of interest to the group.

Rochester Section

At the October meeting of the Rochester Section, Louis M. Gerhardt, of the Aims, Activities and Professional Objectives Committee, reported on the successful elimination of competitive bidding for surveying in connection with the New York City Housing Authority. By vote of the Section, Mr. Gerhardt was granted the authority to correspond with other engineering groups in the area, with a view to securing laws requiring professional qualifications for engineering positions in the city and state. The principal speaker on the technical program was Col. Carey H. Brown, general superintendent of services for the Eastman Kodak Company. His subject was "The Holston Ordnance Work—Makers of RDX." Colonel Brown acted as superintendent of engineering during construction of the Holston Ordnance Works and, after its completion, became works manager.

Tennessee Valley Section

An all-day trip to the atomic bomb plant at Oak Ridge, Tenn., comprised the annual meeting of the Tennessee Valley Section, which was held on November 10. There was an attendance of 125, with members present from the Asheville, Chattanooga, and Knoxville Sub-Sections. During the brief business session held in the morning certificates of life membership were presented to William H. Sears, of Chattanooga, and Ross M. Riegel, of Knoxville. The meeting then adjourned to convene again with local groups of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers to hear lectures about the Oak Ridge project and to make inspection trips. First, Maj. T. J. Rentenbach gave a talk on the construction and administrative problems at Oak Ridge, the description of the housing being of special interest to the group. A tour of the Y-12 plant was then taken, though only exterior inspection was possible. Following luncheon, Col. K. D. Nichols welcomed the group to Oak Ridge and Otto Manz described the large steam-generating plant at the project. A tour of the K-25 area concluded the program.

Texas Section

The Fort Worth Branch of the Texas Section held meetings on October 8 and November 12. The programs on both occasions consisted largely of business discussion, though Oscar King gave a talk and led a discussion at the first of these meetings. Mr. King, who is director of the Society's Committee on Postwar Planning, discussed the relationship between the committee and the Committee on Economic Development, outlining the method of estimating the annual expenditure for total construction and apportioning the share that should go for public works construction.

Toledo Section

An unusual program had been arranged for the November 7 meeting of the Toledo Section, the speakers being Detective Captain Arthur Eggert and his assistant, Detective Lieutenant George Eckerman, both of whom are with the city of Toledo. Captain Eggert outlined the procedure in giving a lie-detector test, pointing out that many metropolitan cities are solving crimes with the aid of crime-detection laboratories. To date, he said, over 7,000 cases have passed through the Toledo department, and a number of these have been brought to completion by the use of the lie detector.

Tri-City Section

At the annual business meeting of the Tri-City Section—held in Davenport, Iowa, on November 7—new officers were elected for the coming year. These are as follows: H. S. Smith, president; G. M. Wood, vice-president; and A. F. Burleigh, secretary. The speaker of the evening was H. P. Warren, chief of operations for the U.S. Engineer Office at Rock Island, Ill., who presented a paper on the history of the Panama Canal. Mr. Warren is well versed in his subject, having been engineer of construction on the Panama Railroad.

West Virginia Section

Members of the West Virginia Section met in Charleston, W.Va., on November 12 for luncheon and afternoon technical and business sessions. After lunch had been served, the group was addressed by Earl B. Smith, manager of the Territorial Development Department of the Monongahela Power Company at Fairmont, W.Va., on the subject, "Engineering Community Development." Later in the afternoon two official U.S. Navy films—on the Seabees and hangar construction for lighter-than-air craft—were shown. Then Kenath Kettle, until lately a lieutenant in the Civil Engineer Corps of the U.S. Naval Reserve, described his experiences with the Seabees. A business meeting concluded the day's events.

Student Chapter Notes

Manhattan College

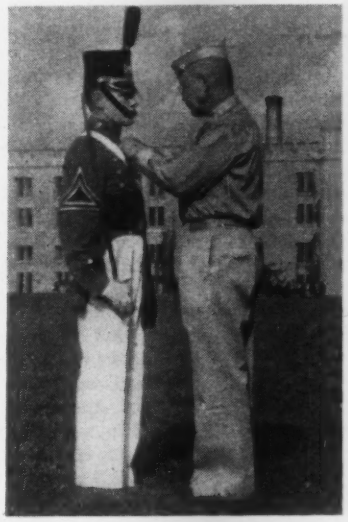
Members of the Manhattan College Student Chapter enjoyed two meetings in November. On the 14th, John Bethel, captain, Corps of Engineers, U.S. Army, addressed the group on "The Scope and Application of Sanitary Engineering." In his talk Captain Bethel discussed the sanitary engineer as a civil engineer, chemist, and bacteriologist, emphasizing particularly the application of sanitary engineering to Army work. A film on the bridging of San Francisco Bay comprised the technical program at the meeting held on the 28th.

Rensselaer Polytechnic Institute

The Rensselaer Polytechnic Institute Chapter reports that a highly successful dinner meeting, held at the Crooked Lake Hotel near Troy, N.Y., initiated the fall and winter season. Following dinner, D. H. Harkness, who is Society Contact Member for the Chapter, outlined the work of the Society and discussed the connection between the Chapter and the Society. Joseph C. Brennen then gave an illustrated talk on the construction of the railroad line from North Creek to Sanford Lake, N.Y. Mr. Brennen, who was in charge of construction on this project, described the engineering problems that had to be overcome in constructing a line through the heart of the Adirondacks.

Virginia Military Institute

Many of the veterans returning to colleges in this country, under the "G.I. Bill of Rights," wear decorations for bravery—not only those of the United States, but from foreign countries as well. Such a veteran is Cadet James Irving Beale, 3rd, of Franklin, Va., who is now a civil engineering student at Virginia Military Institute and Cadet Battalion Supply Sergeant. For gallantry in action in France on August 30, 1944, when he was wounded, Cadet Beale received the Silver Star Medal. Later the French government awarded him the Croix de Guerre, which did not reach him until he had taken up his studies at Virginia Military Institute. As shown in the accompanying photograph, the award was pinned on him by Col. John Fray at a special review held on the Virginia Military Institute grounds on September 24, 1945.



CADET BEALE, OF VIRGINIA MILITARY INSTITUTE CHAPTER, RECEIVES THE CROIX DE GUERRE

ITEMS OF INTEREST

About Engineers and Engineering

Tribute Paid to American Engineers by General Reybold

"WITHOUT American construction talent we could not have won the war. Without all of America's construction talent we may not win the peace." Thus in a recent essay addressed "To the Corps of Engineers and to Those Who Work with Us," Lt. Gen. Eugene Reybold, M. ASCE, retiring Chief of Engineers, emphasized the importance of engineering, both military and civil, in the course of human affairs.

As Chief of Engineers during World War II, General Reybold was directly responsible for the greatest volume and variety of construction yet performed. In this essay, entitled "Engineers in World War II, a Tribute," he recalls that in June of 1942 he wrote to American contractors:

"I can think of no type of work a contractor can perform which is not represented on the books of the Corps of Engineers and which is not now being carried out somewhere on the vast program you are building for a nation at war. There is no problem we have yet encountered that has not been readily solved through the ability and resources of the American construction industry." He goes on to recall that earlier, in January 1942, he had said to the American Society of Civil Engineers' District of Columbia Section, "We may as well face the fact that, for a long time to come, there will be no 'engineering as usual' in this country." And, regarding the military construction job, he had pointed out to them that "When that program first took shape, one salient fact became evident: the program was beyond the existing capacity of any governmental construction agency—but, it was not beyond the capacity of the American engineering profession."

BUILDING DEMOCRACY'S ARSENAL

In another connection, he has stated:

"We—the Army Engineers—were confronted with the necessity either for enlarging radically our engineering staffs, or, alternately, finding another method of accomplishing the greatly increased volume of design work thrown upon our shoulders. We met this particular problem by invoking the so-called 'architect-engineer' form of contract. By this we have, in effect, contracted out such engineering work as was beyond the capacity of our existing staffs."

The essay continues:

"In retrospect it is apparent that what was happening in those hectic months of late 1940 and through 1941 was the complete conversion of the American construction industry and its allied engineering professions and government services to the task of building democracy's arsenal. By June of 1942, with Army construction alone going into place at a rate of $20,000,000 every 24 hours, the face of America—and the fate of the world—was being reshaped by the hammers and saws and heavy equipment of the greatest construction gang ever brought together."

General Reybold's tribute to the engineer concludes with the following paragraphs:

"I am equally conscious of America's good fortune in possessing in its construction industry and allied engineering professions a reservoir of work-power uniquely combining the virtues of keenly competitive "hustle" with high professional standards of honest performance. In a very true sense, the American construction industry and engineering profession took on a blanket contract to perform whatever construction and engineering would be prerequisite to victory. The lives of many of their men were the bond guaranteeing their best performance on that contract. It was a contract of which every man and woman in the industry had a piece. Victory was the last nail in the roof of their completed structure.

"What I would like to express, therefore, is the deep conviction that the peculiar genius of the American builder—his delight in taking on new jobs, however big; his ability to organize on a vast scale; his pride in honest work; his refusal to admit failure; his innate and fostered capacity for overcoming obstacles; his talent for multiplying work-power through new equipment and new methods—these attributes which have made American builders and engineers the wonder of the world, should be encouraged as the cornerstone of an enduring America. Without American construction talent we could not have won the war. Without all of America's construction talent we may not win the peace. It is not idle talk to say that we must build a better world. But it is idle merely to talk about the building; we must get the projects under way.

"In five years of war, American construction men and engineers, both in and out of uniform, have acquired more experience than the industry has ever before possessed. In five years we have built up greater inventories of building equipment than the world has hitherto seen. In five years we have made a new exploration of the world—exceeding even that of the seventeenth century. In trained men, in equipment, in technical data, we have inherited out of War's Pandora Box of Evils the one great hope of building an environment which would partly fulfill President Truman's expressed hope that we can convert our military exertions to the causes of peace.

"But we, as a people, must not let the opportunity pass. The knowledge we have acquired, the inventories of equipment, the skills and courage and confidence of the men who have built our victory must not be locked out now that peace is ours to have and hold.

"We must keep building."

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. ASCE

"I HAD HOPED," said Professor Neare, "to tease you gentlemen of the Engineers Club with a Happy-New-Year problem built around the number 1946. It factors into 139·2·7, which suggests the series 1,3,9,27; it also can be synthesized from squares by splitting 16 and inserting 9 and 4. However these reflections are amusing only to numerologists and not at all provoking to engineers. Not all year numbers are so casual, as the following example will show.

"Some years ago a thotful old man sent birthday greetings to his grandson, adding, 'Although comparisons are odious, your

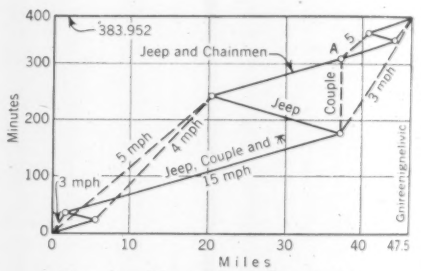


FIG. 1. NOVEMBER SOLUTION

age combined with mine is the year, and my age is the product of yours and your kid sister Anne's.' The boy wrote back, 'Not only is the year the combination of your age and mine, but all 3 numbers are perfect squares!' Of course, the classical question is, 'How old was Anne?'"

"And of course," asked the precise Ken Bridgewater, "*age* is the age in years at last birthday?"

"Of course," echoed the Professor. "And now that the new assignment is agreed to, let's dispose of that November problem—to jeep a lazy chief-of-party, a lame transitman, a fast head chainman, a slow rear chainman and a non-cooperative newlywed flagman and wife from here to Gnireenignelivic in a hurry."

"I've been so envious of Tom's 5-man party that I haven't worked the problem," confessed Cal Klater. "My transitman claimed his old job after having worked up to a majority in the Army Air Service; he also claimed he was entitled to promotion to chief-of-party, so I had to run the instrument myself. What's more, he threw away my transit and made me use an oc-

tant! Chainmen? I've only one so far, which means he has to break every 2 ft; he'd make better time with a yardstick. How about trading parties with Tom, and an octant for the flagman's wife?"

"If Cal didn't work the problem, you'll have to use my solution," threatened Joe Kerr. "In this Time-Space Chart (Fig. 1), the routing as far as *A* is geometrically similar to the whole routing of the original problem, to the scale ratio 98:125. The couple sits out at this point for 134.064 min while Gimpy starts on afoot and the jeep fetches the chainmen, after which the couple is ensconced in the back seat and the chainmen take turns riding. The ferrying is complete in 383.952 (exactly) min."

"For once, you're right," conceded the Professor. "If the couple had needed a chaperon, the time would have been 399 min as before. Now that you've shown Cal the routing, he may enjoy setting up the 6 simultaneous equations—if his new hired boss gives him an evening off."

Manual of Procedure Under Government Contracts

OF VALUE to firms interested in, or now supplying, goods or services to the Federal Government is the "Manual of Procedure Under Government Contracts," by O. R. McGuire, recently issued in its fourth edition. This pamphlet is published by the Fidelity and Deposit Company of Maryland and the American Bonding Company of Baltimore, and may be obtained, without cost or obligation, on request to either of these companies in Baltimore, Md.

Report on Inland Waterway, Orinoco to Amazon Rivers, South America

A REPORT is now available on a proposed inland waterway in South America between Ciudad Bolivar, Venezuela, head of navigation on the Orinoco River, and Manaus, similarly located on the Amazon in Brazil—or actually on the Rio Negro near its confluence with the Amazon. Some 1,800 miles of waterway are involved, covering three streams in three countries. Correspondingly, the present report is captioned "Orinoco-Casiquiare-Negro Waterway—Venezuela-Colombia-Brazil." According to the report the Canal Casiquiare is a stream flowing out of the Orinoco in a region near the headwaters "to its confluence with Rio Guainia to form Rio Negro." The mileages of the waterway are then about 815 on the Orinoco, 220 on the Casiquiare, and finally 800 miles on the Negro system.

Various plans included in the report cover a (1) "minimum operation"; (2) open river and portage; (3) 6-ft draft, open river and portage; and (4) 10-ft channel, locks and dams. The latter plan involves a $90,000,000 expenditure. Supporting these various proposals, the documents consist of: Volume I, a 300-page report with about 50 drawings; Volume II, entitled "Photographic Record" and including 278 illustrations; and Volume III, in 10½ by 17-in. size, including 166 drawings, some folded.

The work in question was in charge of Lt. Col. H. G. Gerdes, M. ASCE, working under Brig. Gen. John S. Bragdon, of the South Atlantic Division, Corps of Engineers. Originally surrounded by military secrecy, the report is now available for distribution, for which purpose a number of sets have been donated to the Society by Col. Maurice E. Gilmore. These reports have the imprint of the Coordinator of Inter-American Affairs. They are available for distribution as long as the supply lasts, with a nominal charge of 60 cents for handling, upon request to the Society. The report will also be found on file in the Engineering Societies Library.

Permanent Science Fund Grants-in-Aid

INCOME from the Permanent Science Fund, by agreement and declaration of trust, is disbursed by the American Academy of Arts and Sciences in support, of scientific research, including engineering. Applications for grants-in-aid are receivable on multiple forms which will be supplied upon request to the chairman of the committee.

It is stipulated that title to equipment purchased outright from a grant from the Permanent Science Fund resides in the Fund. Also, grants are not made for work in partial fulfillment of the requirements for an academic degree. The committee does not approve requests for general permanent equipment for institutions. Disbursements will be made directly to recipients, as named in the awards, and not to institutions with which recipients may be affiliated. An annual accounting is required as a condition of the grant, and the committee appreciates being informed of the progress of projects supported and the manner in which grants have been utilized.

Address communications to John W. M. Bunker, Chairman, Permanent Science Fund Committee, Massachusetts Institute of Technology, Cambridge, Mass.

Predoctoral Fellowships in the Natural Sciences

ARRANGEMENTS are in force for rendering financial assistance and direction to worthy young men and women who desire to resume work for a doctorate in the mathematical, physical, and biological sciences, following interruption of their studies by the war. The program is under the National Research Council.

Provision is made for an annual payment of $1,200 for single persons or $1,800 for married men, with an additional $500 for tuition and fees; those coming under the "G.I. Bill of Rights" will be accorded the same total financial help. This plan is laid out to secure the most logical and effective prosecution of the work.

Application blanks and other data are available on request. Information may be obtained from the Secretary, Committee on Predoctoral Fellowships, National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D.C.

"Aluminum Bulletin" Launched by Aluminum Association

A QUARTERLY publication has been launched by the Aluminum Association with the issuance of the September number of the *Aluminum Bulletin*. Its purpose is stated to be the same as that of the Association, namely, "to promote the general welfare of the aluminum industry, of the members of it, and all others affected by it, and to increase the usefulness of the industry to the general public."

According to its statement, the *Aluminum Bulletin* is intended to serve members of the Association directly by presenting information gleaned both from within and from outside the industry. Its indirect service will consist of presenting information about the industry to other industries and to the public. In other words, it will be a medium "for reporting both to and from the aluminum industry, about the aluminum industry."

National Directory of Commodity Specifications

FOR DETERMINING whether an applicable standard specification exists for any commodity desired, reference should be made to the "National Directory of Commodity Specifications." The third edition of this, revised and enlarged (1,300 pages), was recently issued by the National Bureau of Standards, Department of Commerce. This directory was first published in 1925 and revised in 1932. The volume lists by title, designating number, and sponsoring organization, the specifications and methods of test of all commodities regularly produced in this country. Each specification is briefly summarized as to technical characteristics, scope, and special applications. These special features will aid the user in selecting specifications suited to his particular needs, and will make the directory almost indispensable to large buyers, whether federal, municipal, or other.

The National Bureau of Standards (Misc. Pub. M178) National Directory of Commodity Specifications may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for $4.00 in the United States and possessions, and for $5.25 foreign. Remittance should be by check or money order payable to the Superintendent of Documents.

Publications on Road Problems

OF INTEREST in connection with post-war projects, as well as in solving problems caused by wartime shortages, is the group of numbered bulletins on "Wartime Road Problems" published by the Highway Research Board. They include:

1. Curing Concrete Pavements Under Wartime Restrictions on Critical Materials (10 cents)
2. Design of Highway Guards (10 cents)
3. Design of Concrete Pavements Requiring a Minimum of Steel (10 cents)
4. Maintenance Methods for Preventing and Correcting the Pumping Action of Concrete Pavement Slabs (10 cents)
5. Granular Stabilized Roads (25 cents)
6. Patching Concrete Pavements with Concrete (10 cents)
7. Use of Soil-Cement Mixtures for Base Courses (20 cents)
8. Thickness of Flexible Pavements for Highway Loads (10 cents)
9. Recommended Practice for Treatment of Icy Pavements (10 cents)
10. Salvaging Old High-Type Flexible Pavements (25 cents)
11. Compaction of Subgrades and Embankments (25 cents)

The Highway Research Board has also announced the publication of its *Proceedings*, Vol. 24 (about 500 pp., $5.00), and of "Papers on Maintenance of Joints in Concrete Pavements as Related to the Pumping Action of Slabs" (mimeograph, bound, 140 pp., $1.00).

These publications may be secured on request to the Highway Research Board, National Research Council, Washington 25, D.C.

"The Case for the Red River Lateral Canal"

THE Louisiana State Department of Public Works has completed a report on the economic feasibility of constructing a canal up the Red River Valley to furnish slack-water navigation, drainage, and flood control. Its findings have been summarized for presentation to the Corps of Engineers in a 52-page illustrated pamphlet, entitled "The Case for the Red River Lateral Canal." Great interest in the report has been aroused locally, as construction of the lateral canal, with its plan to utilize existing bayous for its course, would mean that every major Louisiana city would have water freight transportation and be a part of the great Mississippi waterway system.

Data for the report were compiled under the direction of Leo M. Odom, M. Am. Soc. C.E., chief engineer for the State Department of Public Works. DeWitt L. Pyburn, M. Am. Soc. C.E., devoted to the work the full facilities of the Department, of which he is director.

Notable History Commemorated by Fairbanks-Morse

THE PRESENT seemed an auspicious time to Fairbanks-Morse and Company for setting down its notable record of achievement. Many significant events are recorded in a handsomely illustrated 160-page book issued under the title "Pioneers in Industry." It indicates how the Yankee ingenuity of the Fairbanks family established a manufactory for scales and other products in Vermont. This was in 1830. The Morse influence, although not added to the combination until several decades later, still persists in responsible charge of the organization. The result of this wise affiliation was a broadening of the business to include gasoline and later Diesel engines, motors, pumps, and a similar variety of products, culminating in large war activities.

Thus, in a graphic and instructive way the booklet covers 115 years of productive industry. With understandable pride it records development and responsibility for products with which all engineers have occasion to deal. The volume is on file at Society Headquarters.

Monthly Bulletin on Construction Issued by Department of Commerce

IN KEEPING with its policy of improving its service to industry, the Bureau of Foreign and Domestic Commerce of the U.S. Department of Commerce recently instituted a monthly publication on "Construction and Construction Materials," an "Industry Report." This report is divided into two sections—on construction and on construction materials. The first part is a concise summary of current activity, the second contains data on materials of interest to the construction industry.

Since the goal of this publication is to serve its users, the Bureau will welcome suggestions for its improvement. In the months to come it hopes to shape these reports so that they will truly meet the needs of the construction industry for statistical commentaries on current construction trends. Suggestions or inquiries regarding this publication should be addressed to the Construction Division, Bureau of Foreign and Domestic Commerce, Washington 25, D.C.

New in Education~

Curricula Changes at Michigan College of Mining and Technology

AMONG MANY changes this year at the Michigan College of Mining and Technology, a major one is the separation into three departments of what for nearly twenty years has been the combined department of civil engineering, mining engineering, and economics.

In civil engineering three courses have been added—hydrology, aerial surveying, and airport engineering. Others have been revised, and four "options" have been set up—in construction, hydraulic, sanitary, and transportation engineering. Finally, the new civil engineering curriculum makes much more provision than the former one for the "humanistic-social stem" recommended in the report of the 1944 ASCE Committee on Engineering Education and also by the Society for the Promotion of Engineering Education. The new head of the civil engineering department is Prof. W. C. Polkinghorne, M. ASCE, member of the State Board of Registration for Engineers, Architects and Land Surveyors.

The scope of the economics department has been enlarged and it has been renamed the Department of Engineering Administration. Courses taught include not only economics but personnel relations, industrial psychology, industrial sociology, and American government and politics, the purpose being to better equip engineering graduates to fill administrative and executive positions. The college grants degrees in civil and in mining as well as in seven other branches of engineering and in four sciences. Engineering Administration, however, is not a degree-granting curriculum.

* * * *

Research Management Course at New York University

LAST YEAR, the Graduate Division, College of Engineering, New York University, offered a graduate course on the Management of Research and Development, set up to take care of the rising needs of industry for men who have had some training in this field. As the need is greater now than ever before, it has been decided to repeat the course beginning January 31. The registration period is January 21–24, inclusive.

The lectures will be given by a distinguished group of directors of research of leading companies, on the following topics:

- The Philosophy and Application of Industrial Research
- The Organization of the Industrial Research Laboratory
- The Qualifications, Training, Aptitudes and Attitudes of Personnel
- Selecting Problems for Research
- The Expansion or Abandonment of the Investigation
- Transfer of Laboratory Results to Factory Production
- The Interpretation of Experimental Data and the Application of Statistical Analysis
- The Preparation of the Report of the Investigation
- Selling Industrial Research to Management
- Economics of Industrial Research, Accounting Practice and Preparation of the Research Laboratory Budget
- The Design of the Industrial Research Laboratory
- Research in Small Business

Place of the Consulting Laboratory, Research Institute, and University Laboratory in Industrial Research
The Problem of Patents in Research Laboratory Management
Significant Trends in Industrial Research and Government Policy Toward Research

* * *

Georgia School of Technology Offers Graduate Awards

TO HELP FILL the needs of industrial, research, and educational organizations in the South for engineers and scientists with graduate training, the Georgia School of Technology is expanding considerably its Division of Graduate Studies, starting with the opening of the spring term on March 4, 1946. The Division is offering a series of graduate awards, ranging up to $1,800 per academic year, in engineering and allied sciences to qualified graduates of Georgia Tech and other colleges and universities in the United States. In general, the awards will consist of research fellowships, graduate fellowships, research assistantships, graduate assistantships, and part-time instructorships. For detailed information, write to the Dean, Division of Graduate Studies, Georgia School of Technology, Atlanta, Ga.

* * * *

Sanitary Engineering Research Advisory Board at Purdue

A SANITARY Engineering Research Advisory Board has been set up at Purdue University for the purpose of advising on research projects to be undertaken by the Sanitary Engineering Department, the aim being to make sure that this research is of maximum benefit to the citizens of the state, the consulting engineers, and industry. The Board's expenses will be taken care of by a $1,000 fund given to the Department by the Hulman Foundation of Terre Haute. Members of the Board, in addition to Anton Hulman, its chairman, are: J. L. Quinn, vice-chairman; Don E. Bloodgood, secretary; and C. K. Calvert, R. B. Wiley, W. W. Mathews, W. E. Howland, L. S. Finch, M. H. Schwartz, and B. A. Poole. All except Messrs. Hulman, Mathews, and Schwartz have membership in the Society.

The Advisory Board held its first meeting in the Civil Engineering Building at Purdue in November. On this occasion the Acting President of the University, A. A. Potter, welcomed the Board and expressed his appreciation for its cooperation. Following a discussion of projects under way and contemplated, the Board inspected the Sanitary Engineering Laboratory and two of the projects.

* * * *

University of Colorado Receives Donations for Research

MIDWEST Iron and Steel Works Company, of Denver, has donated $750 for research studies in civil engineering at the University of Colorado. Prof. Warren Raeder, head of the department, says that the money will probably be used in investigating engineering problems which arise in the fabrication of steel structures. Midwest Iron and Steel is a large-scale fabricator of structural steel for buildings, industrial plants, and other construction projects.

Two fellowships, to be known as the Charles Boettcher Fellowships, have been established at the Engineering Experiment Station of the University of Colorado by the Ideal Cement Company of Denver. The fellowships, which honor Charles Boettcher, pioneer Colorado industrialist and president and founder of the Ideal Cement firm, will be used for applied research on concrete. The first studies will be on the strength and composition of concrete made with aggregates available in the Denver metropolitan area, in order to find the best mixes using these aggregates. Similar studies are planned on the aggregates available in other parts of Colorado.

* * * *

Research Fellowship Available at University of Utah

THE Department of Civil Engineering of the University of Utah has announced that it will have available a research fellowship amounting to $600 for a graduate civil engineer who is interested in going on and taking his master's degree. The work will be primarily research, and has good possibilities of expanding to a permanent position. Particulars may be secured from Prof. A. Diefendorf, M. ASCE, Head of the Department of Civil Engineering, University of Utah, Salt Lake City, Utah.

NEWS OF ENGINEERS

Personal Items About Society Members

WILLIAM P. KIMBALL has been elected dean of the Thayer School of Engineering at Dartmouth College. Dean Kimball, who assumed his post on November 1, has been acting dean for the past six months and, before that, was assistant dean under the late FRANK WARREN GARRAN.

FRANK A. BUSSE announces that he is resuming his general engineering practice in the Shrine Building in Memphis, Tenn., where he will specialize in structural engineering, foundation engineering, and industrial buildings. Since January 1941 Mr. Busse has been engaged in war work, his services having included work on the atomic bomb plant at Oak Ridge, Tenn., and the rocket plant at Camden, Ark.

TRAVIS L. SMITH, III, major, Corps of Engineers, U.S. Army, has been enjoying terminal leave at his home in Houston, Tex., and now will accept an appointment as assistant public works director of that city. For the past two years Major Smith has been in Burma and China.

JACOB WEGWEISER has returned to New York City after serving for three years as lieutenant in the Civil Engineer Corps of the U.S. Navy. While overseas he participated in the construction of advanced bases in the South Pacific, having been on duty with the Seabees.

THEODORE J. KAUER recently assumed new duties as managing director of the Wire Reinforcement Institute, with offices in the National Press Building in Washington, D.C. He has also been named secretary and treasurer of the organization. Mr. Kauer comes to his new position from that of assistant managing director of the American Concrete Pipe Association, with which he has been connected since 1941.

RICHARD A. HERTZLER has been transferred from the Forest Products Laboratory, U.S. Forest Service, Madison, Wis., to the Appalachian Forest Experiment Station at Asheville, N.C. He is now in charge of the Forest Utilization Service, a unit recently established to achieve greater utilization of the forest resources of the region, partly through liaison between the Forest Products Laboratory and the wood-using industries.

FRANK C. DUGAN has resumed his position as chief engineer of the Kentucky State Health Department after three and a half years' service with the U.S. Army, in which he held the rank of major in the Sanitary Corps.

FRANK B. CAMPBELL, commander, Civil Engineer Corps, U.S. Naval Reserve, announces that he is on terminal leave at Rockwell City, Iowa, having recently returned from Iwo Jima.

WILLIAM G. GROVE has resigned as consultant on bridges for the U.S. Engineer Board at Fort Belvoir, Va., in order to accept an appointment as engineer of bridges and structures in the Connecticut State Highway Department, with headquarters in Hartford, Conn.

T. KEITH LEGARÉ ended his three-year connection as district manager for South Carolina of the War Production Board with the termination of the Board on November 3. Mr. Legare, who has been executive secretary of the National Council of State Boards of Engineering Examiners for 22 years on a part-time basis, will hereafter give his entire time to this work and to the South Carolina State Board of Engineering Examiners, of which he is also secretary. He is a former Director of the Society.

CHARLES P. BLANKS, JR., captain, Sanitary Corps, U.S. Army, is now director of the Sanitation Section of the Bureau of Public Health, Military Government in Korea. A former member of the Health and Safety Department of the Tennessee Valley Authority at Paris, Tenn., Captain Banks entered the Army in May 1942.

CLARK KITTRELL, colonel, Corps of Engineers, U.S. Army, assumed new duties on November 19 as division engineer of the Upper Mississippi Valley Division, with headquarters in St. Louis, Mo. He will relieve MALCOLM ELLIOTT, who is retiring. Colonel Kittrell has been district engineer of the New Orleans District and division engineer of the Middle Atlantic Division, and during the war was overseas on various assignments—most recently in Cairo, Egypt.

FRANCIS W. HERRING has just been promoted to the rank of commander in the Civil Engineer Corps of the U.S. Naval Reserve. He is head of the Historical Division of the Bureau of Yards and Docks, with headquarters in Washington, D.C.

O. J. TODD, who is on a year's leave of absence from his position as senior engineer in the U.S. Engineer Office at Los Angeles, Calif., has left for China, where he will serve as adviser to the Yellow River Conservancy District for the United Nations Relief and Rehabilitation Administration.

CHARLES A. SELBY was recently relieved from active duty in the Field Artillery of the U.S. Army, in which he held the rank of colonel, and is now returning to the position of treasurer of the Nicholson Company and secretary-treasurer of Winninger and Selby, Inc., of New York, N.Y. In the Army since October 1940, Colonel Selby was awarded the Bronze Star Medal in May 1945.

JOHN JOSEPH MANNING, rear-admiral, Civil Engineer Corps, U.S. Navy, has received President Truman's appointment as chief of the Bureau of Yards and Docks for a four-year term. He will succeed VICE-ADMIRAL BEN MOREELL, chief of the Bureau since December 1937, who has been appointed chief of the Material Division in the Office of the Assistant Secretary of the Navy. A member of the Civil Engineer Corps since 1918, Admiral Manning has held numerous important assignments, having been director of the Atlantic Division of the Bureau from November 1942 to June 1945, and director of the Eastern Pacific Division since the latter date.

M. K. SNYDER is retiring as head of the civil engineering department at Washington State College, a position he has held since 1931. He expects to make his home in Sequim, Wash.

ALEXANDER BREST has joined the staff of the J. P. Riddle Company, of Miami, Fla., after three years in the Corps of Engineers of the U.S. Army, in which he held the rank of lieutenant colonel. Before entering the service, Colonel Brest was with the Duval Engineering and Contracting Company.

B. A. POOLE, who was recently released from the Corps of Engineers, U.S. Army, in which he was a major, has resumed his connection with the Indiana State Board of Health. He will be director of the Division of Environmental Sanitation.

ALFRED D. COONS is resigning as city engineer of Davis, Calif., in order to serve in a similar capacity at Pacific Grove, Calif.

E. C. DEGARMO, assistant state highway engineer for the Florida State Road Department, will be in charge of the Department's new field office at Orlando, Fla.

JAY DOWNER announces that he has formed an engineering partnership with WHARTON GREEN and E. J. Carillo. The new firm will be located in New York City.

THOMAS M. ROBINS, major general, Corps of Engineers, U.S. Army, recently retired as Deputy Chief of Engineers after forty years of Army Service. He has held the rank of major general since 1942, and had served as Deputy Chief of Engineers since October 1943.

JAMES H. STRATTON, brigadier general, Corps of Engineers, U.S. Army, has been made director of the Civil Works Division in the Office of the Chief of Engineers. He was previously special assistant to the Chief of Engineers.

BERNARD R. FULLER, until lately hydraulic engineer for the Tennessee Valley Authority at Knoxville, Tenn., has become senior hydraulic engineer for the U.S. Engineer Office at Buffalo, N.Y.

VERNON S. ELLINGTON is now city manager of Muskogee, Okla.

NATHAN B. BEDERMAN has returned from service in the U.S. Navy, in which he held the rank of commander. He is now president of the Arcole Midwest Corporation of Chicago, Ill.

WINFIELD H. ARATA, formerly senior civil engineer in the U.S. Engineer Office in San Francisco, Calif., has accepted the position of executive secretary and manager of the Northern California Chapter of the Associated General Contractors.

JOEL C. BEALL has severed his connection with the Memphis (Tenn.) City Health Department in order to accept a position with the U.S. Public Health Service. Mr. Beall will be in charge of work on typhus control in one of the southeastern areas, with headquarters in Atlanta, Ga.

ROLF ELIASSEN, major, Corps of Engineers, U.S. Army, has been assigned to new duties as head of the sanitary engineering department of the newly established school operated by the Army. Prior to entering the service, Major Eliassen was on the civil engineering staff at New York University.

DECEASED

JAMES HOBART ALLPORT (M. '13) consulting engineer of Barnesboro, Pa., died on June 11, 1945. He was about 70. Mr. Allport spent his early career in mining engineering and development, having been connected with the Benton Coal Company, the Rich Hill Coal Company, and the Federal Coal Company. At one time, also, he was consulting engineer for, and president of, the Clinchfield Coal Corporation. For many years—from 1896 to 1909 and since 1917—Mr. Allport also maintained a general consulting practice at Barnesboro.

FREDERICK GARDNER BENNETT (Assoc. M. '22) civil engineer of Far Rockaway, N.Y., died in May 1945, at the age of 62. In his early career (1907 to 1916) Mr. Bennett was with the New York City Board of Water Supply, and from 1917 to 1920 was assistant engineer for Hill and Ferguson, New York City consultants. Later he was assistant engineer in the Division of Hydrology, New York Water Power Investigation, and more recently he maintained a civil engineering practice in Mineola, N.Y.

EDWARD EMERY CARPENTER (M. '12) retired engineer of Vancouver, B.C., died in that city on October 26, 1945. Mr. Carpenter, who was 72, was with the British Columbia Electric Railway Company, at Vancouver, from 1923 until his retirement in 1943. During this period he was consulting engineer for the company on the design and construction of hydroelectric and steam projects. Earlier in his career he had been in charge of several pioneer hydroelectric developments for the engineering firm of Sanderson and Porter, and he was at one time a partner in the firm of Baker, Carpenter and Waters, engaged on the design and construction of the Stanford University Stadium and other similar projects.

WHITMAN STRATTON CARPENTER (Jun. '43) lieutenant, U.S. Marine Corps Reserve, was killed in action on Iwo Jima on February 21, 1945. Lieutenant Carpenter was 23, and an alumnus of the Virginia Military Institute, class of 1943. Since his graduation he had been in the service. Lieutenant Carpenter's home was in Middletown, N.Y

JAMES LELAND CRIDER (M. '06) of Mount Vernon, N.Y., died in a hospital there on November 27, 1945, at the age of 77. A specialist in railroad construction, Mr. Crider was engineer in charge of the construction of the New York, Westchester and Boston Railway, connecting the Bronx and Westchester County; and of the Oakland, Antioch, and Eastern Railroad, a suburban line between Oakland and Sacramento, Calif. Both of these short-line railroads have been discontinued. Mr. Crider also conducted mine surveys in Canada and oil-transport surveys in Venezuela, and during the first World War was chief engineer on the construction of emergency shipyards at several United States ports. He retired about ten years ago.

MYRON SAMUEL FALK (M. '09) of Greenwich, Conn., died in New York City on November 26, 1945, at the age of 67. From 1900 to 1910, Mr. Falk was on the civil engineering faculty at Columbia University; and from 1906 to 1930 he was chief engineer for the Godwin Construction Company, and from 1909 to 1928 chief engineer for H. H. Oddie, Inc. For part of this period he, also, maintained a consulting practice in New York, serving as consultant on the erection of Temple Emanu-El and other notable structures. He retired from active work a few years ago, but in 1941 was appointed by the War Department as consulting engineer to the Ordnance Department. In the latter position he assisted in the construction of sixty ammunition plants, receiving for his services the civilian award of merit. Mr. Falk was, also, well known as the author of standard textbooks on the design of bridges.

HARLEY EDGAR FRYE (M. '12) retired civil and consulting engineer of Marietta, Ohio, died in Lowell, Ohio, on November 10, 1945. Mr. Frye, who was 79, spent much of his career with the U.S. Corps of Engineers on Ohio River surveys and on the construction of locks and dams on the Ohio and its tributary streams. He, also, was in charge of early levee construction

AT MILL CREEK . . .

Six 6500-hp G-E motors provide the muscle for pumping more than 4,000,000 gpm — in Ohio's largest flood-control project.

6500-hp vertical synchronous motors in Mill Creek Pumping Station. Note the use of unusual built-in gage boards with instruments for recording bearing and winding temperatures. This control system not only keeps the Ohio from backing up but also drains off excessive rainfall, melting snow, and mounting headwater that would ordinarily swamp the low valley.

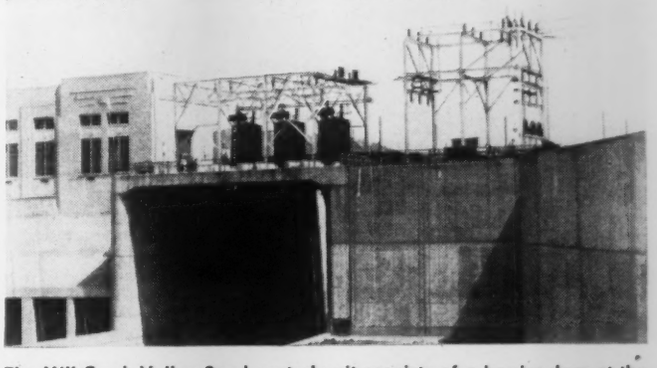
With G-E motors, control, and substation, Mill Creek Pumping Station is almost completely G-E equipped.

This Cincinnati pumping station contains most of the electric equipment to drive six S. Morgan Smith stationary-blade propeller-type pumps. The structure is the largest ever built for its purpose, as are each of the pumping units. The six 6500-hp vertical synchronous motors were designed by General Electric to operate each of the pumps against a 29-foot head, 1500 cubic feet of water per second, or 9000 cubic feet per second total.

The pumps were located below the flood level of the river, and a siphoning action occurred. This was reflected as an unusual peak in the pump's starting torque requirements. To get over this starting peak it was necessary for G-E engineers to design a motor with the proper torque characteristics, yet without increasing the size or cost of the motor. At the same time all six motors had to start without causing excessive disturbance to the power system.

But G.E.'s part didn't stop there. G-E engineers helped to design and co-ordinate the entire electric system, laying out substation equipment to supply power to the pump motors, and installing a completely co-ordinated control system, factory-assembled and tested. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

General Electric's contribution to the Mill Creek project was typical of the Company's service to the construction industry. Our engineers have worked closely with other engineers and pump manufacturers on flood-control projects since 1933. Among these are the projects at Cypress Creek and Nonconnah in Memphis, the Mississippi River project, the Deshee Ditch pumping plant near Vincennes, and the New England flood-control projects. G-E engineers stand ready to co-operate with you in your construction planning.



The Mill Creek Valley flood-control unit consists of a barrier dam at the mouth of the creek, this modern pumping station, and a large discharge bay. Located beside the pumping station are Type H 5000-kva transformers and other power-distribution equipment, with high voltage of 66,000 and low voltage of 6900.

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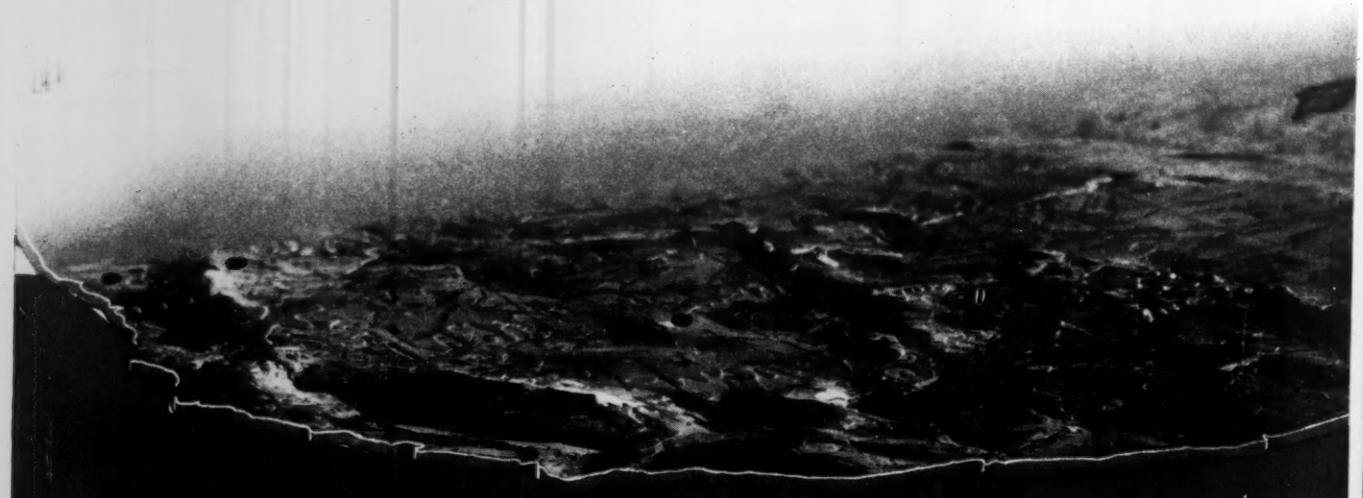

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work along the Mississippi for the Mississippi River Commission and, more recently, was city engineer of Marietta. From 1933 until his retirement in 1941 he was in private practice in Lowell.

HERBERT MORGAN GALLAGHER (M. '22) senior engineer for the Defense Plants Corporation at New Orleans, La., was fatally stricken while on a business trip to Washington, D.C., and died in a hospital there on November 11, 1945. He was 58. Mr. Gallagher was for some years chief engineer of the Port of New Orleans, resigning in 1922 to become port manager at Charleston, S.C. Three years later he returned to New Orleans to join the John F. Coleman engineering firm. Except for a brief period with the Reconstruction Finance Corporation, Mr. Gallagher remained with the latter firm until about two years ago, when he became connected with the Defense Plants Corporation.

FRANK GILBERT JONAH (M. '03) Honorary Member of the Society and chief engineer of the St. Louis–San Francisco Railway, St. Louis, Mo., died there on December 7, 1945, at the age of 81. A biographical sketch and photograph of Colonel Jonah appear in the "Society Affairs" section of this issue.

RICHARD SMITH LEA (M. '08) consulting engineer of Montreal, Canada, died in Charlottetown, Prince Edward Island, on November 10, 1945. Mr. Lea, who was 79, was on the staff of McGill University from 1893 to 1903. For part of this period he was also consulting engineer to the Board of Health, Province of Quebec, and beginning in 1900 he was for some years a member of the consulting firm of Lea and Coffin. During his long practice he served as a consultant on construction projects in every part of Canada.

JOHN BUCK LEONARD (M. '09) of San Francisco, Calif., died on February 16, 1945, though the Society has just heard of his death. He was 80. Early in his career Mr. Leonard was with the American Bridge Company, the Southern Pacific Railroad, and Healy-Tibbets and Company, a San Francisco consulting firm. In 1903 Mr. Leonard established his own consulting practice, which he maintained for a number of years. More recently he was superintendent of the San Francisco Bureau of Building Inspection.

WILFORD BATES RUSSELL (M. '40) chief engineer for the Peerless Cement Corporation, of Detroit, Mich., died on May 28, 1945. Mr. Russell, who was 47, had been with the Peerless Cement Corporation since January 1936. Earlier he had been connected with the Fargo Engineering Company of Jackson, Mich., David R. Cooper, of Syracuse, N.Y., and the R. D. Baker Construction Company, of Royal Oak, Mich. At one time, also, he maintained a consulting practice.

WILLIAM FRANKLIN STROUSE (M. '05) retired engineer of Washington, D.C., died in that city on December 5, 1945. Mr. Strouse, who was 81, was with the Baltimore and Ohio Railroad Company from 1893 to 1920—for a number of years as assistant engineer in charge of the Washington terminal improvements. He then became connected with the Public Service Commission of Maryland in the capacity of chief engineer, later becoming valuation engineer. He retired in 1938.

CLAIRE EUGENE TILTON (Assoc. M. '25) municipal and sanitary engineer and land surveyor, of Phillipsburg, N.J., died on November 28, 1945. In a few days he would have been 50. From 1914 to 1918 Mr. Tilton was assistant town engineer of Phillipsburg, and from 1918 to 1922 town engineer. In the latter year he established a private practice there.

JOHN RUSSELL WISHART, JR. (Jun. '41) of Sharon, Pa., was killed on May 7, 1945, when an airplane, in which he was an instructor, crashed. He was 26 years old. Mr. Wishart graduated from Pennsylvania State College in 1941, with the degree of B.S. in architectural engineering. Following his graduation, he became connected with A. Wishart and Sons Company, of Sharon.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From November 10 to December 9, 1945, Inclusive

ADDITIONS TO MEMBERSHIP

ABBOTT, ALLEN WILLIAM (Jun. '45), Ensign, CEC, U.S.N.R.; 65 Russett Rd., Boston, Mass.

ALBRIGHT, EDWARD PATRICK (M. '45), Engr., Underpinning & Foundation Co., Inc., 155 East 44th St., New York 17 (Res., 164 Country Club Lane, Pelham Manor), N.Y.

ALFONZO-RAVARD, RAFAEL (Jun. '45), Ministerio de Comunicaciones, Sur 2 No. 114, Caracas, Venezuela.

ALPERN, MILTON (Jun. '45), Asst. Test Design Engr., Edo Aircraft Corp., College Point (Res., 756 Union Ave., New York 55), N.Y.

ANDREWS, WILLIAM EARLE (M. '45) (Andrews & Clark), 1 East 57th St., New York 22, N.Y.

BABCOCK, RUSSELL HOWARD (Jun. '45), Ensign, U.S.N.R.; 160 Cottage St., Norwood, Mass.

BERBOWER, RAYMOND FINLEY (Jun. '45), Ensign, CEC, U.S.N.R.; 4307 East 6th St., Long Beach 4, Calif.

BERGMAN, CHARLES ANDREW (Jun. '45), Ensign, U.S.N.R.; 785 Winthrop Rd., San Marino, Calif.

BOYCE, LEON (Jun. '45), Ensign, CEC, U.S.N.R.; 721 Wilson, Fort Scott, Kans.

BOYD, ROY HENDERSON (Jun. '45), Engr., U.S. Bureau of Reclamation, Room 505 New England Bldg. (Res., 1411 Fillmore St.), Topeka, Kans.

BRADFIELD, CURTIS GORDON (M. '45), Comdr. (T), U.S. Coast Guard Reserve; 4200 Loch Raven Blvd., Baltimore 18, Md.

CARPENTER, JAMES DONALD (M. '45), Secy. and Vice-Pres., Gannett, Fleming, Corddry & Carpenter, Inc., 600 North Second St., Harrisburg, Pa.

CHANDLER, ROGER THAYER (Jun. '45), Ensign, CEC, U.S.N.R.; 2547 Forbes St., Jacksonville, Fla.

CHECK, KENNETH GEORGE (Jun. '45), Ensign, CEC, U.S.N.R.; 84 Helwig St., Gloversville, N.Y.

CHLOUPEK, CARL CLAYTON (Jun. '45), Ensign, CEC, U.S.N.R.; 1604 North Linden Ave., Wahoo, Nebr.

COLONNA, ADAMONT FRANK (Assoc. M. '45), Constr. Supt., Constr. Dept., Westinghouse Elec. Corp., Maloney Bldg., Pittsburgh (Res., 1709 Manor Rd., Brookline, Upper Darby), Pa.

DADLANI, AMARLAL VAZIRMAL (Assoc. M. '45), Asst. Research Officer, Irrig. Branch, Public Works Dept., United Provinces (Res., Dhamrahi Lane, Larkana, Sind), India.

DAY, DAVID ALLEN (Jun. '45), 27 East Ave., Ithaca, N.Y.

ENDRISS, RALPH JOEL (M. '45), Structural Designer, E. I. du Pont de Nemours & Co., 11502 Nemours Bldg., Wilmington, Del.

TOTAL MEMBERSHIP AS OF DECEMBER 9, 1945	
Members	6,347
Associate Members	8,065
Corporate Members	14,412
Honorary Members	39
Juniors	6,549
Affiliates	78
Fellows	1
Total	21,079
(December 8, 1944	20,402)

FOGEL, ARTHUR ABRAHAM (Jun. '45), 300 East 34th St., Brooklyn 3, N.Y.

FORNEY, GERARD JOSEPH (Assoc. M. '45), Col., Corps of Engrs., U.S. Army; 104 Ogden Circle, Oak Ridge, Tenn.

GARDE, VINAYAK GOVIND (Assoc. M. '45), Asst. Prof., Civ. Eng., Thomason Civ. Eng. College, Roorkee, U. P., India.

GERDEL, ROBERT WALLACE (Assoc. M. '45), Physicist, U.S. Weather Bureau, Box 2002, Sacramento 9, Calif.

GREVE, NORMAN ROBERT (Jun. '45), 1725 South 2d Ave., Arcadia, Calif.

GROSS, MORTON JEROME (Jun. '45), Ensign, CEC, U.S.N.R.; 3614 East 151st St., Cleveland 20, Ohio.

HAMPTON, ROBERT DAVID (Jun. '45), Chainman, Eng. Corps., N.Y. Cent. R.R., Union Station (Res., 47 Oakwood St.), Albany, N.Y.

HARDY, JAMES BARRON (Assoc. M. '45), Civ. Engr., 839½ South Hobart Blvd., Los Angeles 5, Calif.

HEATH, HARLAN HOWARD (Jun. '45), Ensign, U.S.N.; Morris C42, N.S.C.S. Soldiers Field, Boston 63, Mass.

HELLER, WILLIAM EDWIN (Jun. '45), Ensign CEC, U.S.N.; Route 1, Cashion, Okla.

HELTON, JOHN JACKSON (Assoc. M.'45), Tech. Service Engr., Universal Atlas Cement Co., 630 Brown-Marx Bldg., Birmingham, Ala. (Res., 688 Campbell Circle, Hapeville, Ga.)

HUBER, ROBERT RODNEY (Jun. '45), Junior Hydr. Engr., U.S. Geological Survey, Academy of Natural Sciences, 19th & Parkway, Philadelphia 3 (Res., South Main St., Red Hill), Pa.

JANKE, ARTHUR ALBERT EDWARD (M. '45), Asst. Chf. Engr., Structural Div., Smith, Hinchman and Grylls, Inc., 800 Marquette Bldg., Detroit 26 (Res., 564 Purdy St. Birmingham), Mich.

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KELLY, BENSON FELSHAW (Assoc. M. '45), Engr., U.S. Bureau of Reclamation, Bin 151, Yuma, Ariz.

LEFAN, EWING EUGENE (Assoc. M. '45), Civ. Engr., De Leuw, Cather & Co., 20 North Wacker Drive, Chicago 6, Ill.

LEGGETTE, RALPH MAXWELL (Affiliate '45), Cons. Ground-Water Geologist, 551 Fifth Ave., New York 17, N.Y.

MCINTYRE, THOMAS (M. '45), Deputy Chf. Engr. of Bridges, Bengal and Assam Ry., 3 Koilaghat St. (Res., United Services Club), Calcutta, India.

MELVILLE, PHILLIP LAURENT (Jun. '45), Research Asst., Joint Highway Research Project, Purdue Univ., Lafayette (Res., 176 East Stadium, West Lafayette), Ind.

MILLER, ALFRED ABRAHAM (Jun. '45), Draftsman, Gibbs & Hill, G. & H. Annex—31st St., Pennsylvania Station (Res., 1767 Weeks Ave.), New York, N.Y.

MITCHELL, SIDNEY JAY (Assoc. M. '45), Engr. (Civ.), War Dept., U.S. Engr. Office, Ry. Exchange Bldg. (Res., 2455 West 39th Ave.), Denver 11, Colo.

MORROW, WILLIAM CUBIT (Jun. '45), Ensign, CEC, U.S.N.R.; Deep Dale Rd., Strafford, Pa.

MULLER, RICHARD KENNETH (Jun. '45), Mech. Engr., Naval Research Laboratory, Anacostia Station (Res., 140 Danbury St., S.W.), Washington 20, D.C.

MUSS, DAVID LEON (Jan. '45), San Engr., Heyden Chemical Corp., Princeton (Res., 324 Seventy-eighth St., North Bergen), N.J.

NEISON, FRANK HUNTER (M. '45), Lt. Comdr., U.S.N.R.; 1423 Dufossat St., New Orleans 15, La.

NUSBAUM, ROGER FREDERICK (Jun. '45), Asst. Engr. (P-2B), U.S. Army, Dept. Engr., Panama Canal Dept., Box 5043, Ancon, Canal Zone.

OATES, ROBERT FRANKLIN (Jun. '45), Ensign, CEC, U.S.N.R.; 301 South Frankfort, Russellville, Ark.

OLDSEN, CHARLES BOYD (Jun. '45), Ensign, CEC, U.S.N.R.; 300 South 12th St., Sac City, Iowa.

ORTEGA-SAMPER, JULIO (Jun. '45), With Frederick Snare de Colombia, Ltda., Edificio Sierra 301, Bogota (Res., 11-92 Calle 75), Colombia.

PALMER, DONALD MARION (Jun. '45), Seaman 1/c, U.S.N.; 3419 Agnes, Kansas City, Mo.

PRESTON, CARROLL DEAN (Jun. '45), Ensign, CEC, U.S.N.R.; Lenox, Iowa.

RICHARDSON, GEORGE CARL (Jun. '45), Associate Engr. (Hydr.), U.S. Engr. Office, Chimes Bldg., Syracuse 2, N.Y.

RINELL, AUGUST PETER (Assoc. M.'45), Engr., U.S. Engr. Office, Clock Tower Bldg., Rock Island, Ill.

RIVELAND, ARVIN ROY (Jun. '45), Engr., Lium & Burdick, Cons. Engrs., Y.M.C.A. Bldg. (Res., 2912 University Ave.), Grand Forks, N.Dak.

ROBERTS, HARRISON HARDING (Assoc. M.'45), (Taylor & Taylor Associates), 725 South Spring St., Los Angeles 14, Calif.

ROBERTSON, JOHN RICHARD (Jun. '45), Ensign, CEC, U.S.N.R., 37th Constr. Battalion, Care, Fleet Post Office, San Francisco, Calif.

SCHOEPFLE, ORWELL FRANK (M. '45), Filtration Engr., City of Sandusky, City Hall (Res., 908 Vine St.), Sandusky, Ohio.

SHULLER, ELLIE GIVAN (M. '45), Highway Engr., Creole Petroleum Corp., Apartado 849, Caracas, Venezuela.

SILVER, LEON THEODORE (Jun. '45), Ensign, CEC, U.S.N.R.; E4L, CEC Officer's School, N.C.T.C., Camp Endicott, Davisville, R.I.

SMITH, EWELL RANDOLPH (Assoc. M. '45), Asst. to Public Works Officer, 1st Naval Dist., U.S.N., 150 Causeway St., Boston (Res., 48 Tremont St., Malden), Mass.

SMITH, RAYMOND JAMES (June. '45), Ensign, CEC, U.S.N.R.; 434 Base Line Rd., Glendora, Calif.

SPENCER, FREDERIC WILLIAM (M. '45), Engr. of Planning and Development, Pacific Elec. Ry. Co., 610 South Main St., Room 997, Los Angeles 14, Calif.

STEARNS, HENRY FULLER (M. '45), Dist. Sales Mgr., Chicago Bridge & Iron Co., 57 Forsyth St., North West, Atlanta 3, Ga.

STEPHENS, HARRY HELFERSTAY (Assoc. M. '45), Instr., Mechanics Dept., College of Eng., West Virginia Univ. (Res., 389 Vernon St.), Morgantown, W.Va.

STEWART, ERVYL HARRY (Jun. '45), Ensign, U.S.N.R., *U.S.S. Harry F. Bauer*, D. M. 26, Care, Fleet Post Office, San Francisco, Calif.

STOAKS, DUVAL (Assoc. M. '45), Chf., Organization and Procedures Section, Manhattan Dist., U.S. Engr. Office (Res., 113 Delmar Circle), Oak Ridge, Tenn.

TAN, EK-KHOO (Jun. '45), Research Associate, Princeton Univ., Princeton, N.J. (Res., 370 Riverside Drive, New York 25, N.Y.)

TATE, THOMAS ROUSE (M. '45), Washington Representative, Chas. T. Main, Inc., 314 Denrike Bldg., Washington 5, D.C.

THOMPSON, CLIFFORD JOHN (Assoc. M. '45), Div. Engr., State Highway Dept., Box 1359, 2 Central Ave., West, Great Falls, Mont.

VON GUNTEN, GLENN HARLAND (Assoc. M. '45), Engr., Structural, War Dept., U.S. Engr. Office, 8th Floor Standard Oil Bldg. (Res., 1901 Harrison Rd.), Baltimore 22, Md.

WHITE, ERNEST ALONZO (Assoc. M. '45), Asst. County Road Engr., Pierce County, Court House (Res., 8404 West 27th), Tacoma 6, Wash.

WIGGER, GEORGE FREDERICK (M. '45), Lt. Col., Corps of Engrs., U.S. Army, U.S. Engr. Office, Fort Norfolk, Norfolk 1, Va.

WOOD, MELVIN FREDERICK (M. '45), Mgr., Design Div., E. I. du Pont de Nemours & Co., 10514 Nemours Bldg. (Res., 808 Greenwood, Rd.), Wilmington 79, Del.

WOODY, WILLIAM WORTH (Assoc. M. '45), Civ Engr., Aluminum Co. of America, Box 463 Alcoa (Res., Maloney Rd., Route 3, Knoxville), Tenn.

YODER, ELDON JOSEPH (Jun. '45), Graduate Asst., Joint Highway Research Project, Purdue Univ., Civ. Eng. Bldg., West Lafayette, Ind.

MEMBERSHIP TRANSFERS

BERGQUIST, GUSTAV HARRY (Jun. '42; Assoc. M. '45), Structural Engr., Laramore & Douglas, 327 South La Salle (Res., 3254 West 115th St.), Chicago 43, Ill.

CARRIER, RONALD HENRY (Assoc. M. '39; M. '45), Designing Engr., The Braithwaite Burn and Jessop Constr. Co., Ltd., Box 264, Calcutta, India.

CASSESE, SALVATORE (Jun. '34; Assoc. M. '45), Capt., San. Corps, U.S. Army, Port Surgeon, Fort Mason, San Francisco, Calif.

ELLIOTT, EDWIN WILEY (Jun. '44; Assoc. M. '45), Engr., U.S. Bureau of Reclamation, Box 750, McAllen, Tex.

ERNST, GEORGE CAMPBELL (Assoc. M. '39; M. '45), Associate Prof., Civ. Eng., College of Eng., Univ. of Nebraska (Res., 2045 Euclid Ave.), Lincoln 2, Nebr.

GIARDINI, ANGELO JOHN MARSHALL (Jun. '32; Assoc. M. '45), Pres., The Associated Constr. Co., 738 Main St., Hartford (Res., Carter Ave., Groton), Conn.

GREEN, KENNETH DAVID (Jun. '39; Assoc. M. '45), Capt., R.A.E.; 44 Geelong Rd., Footscray W. 11, Victoria, Australia.

GREEN, STERLING STEFFEN (Jun. '31; Assoc. M. '41; M. '45), Materials Engr., Dept. of Water and Power, Box 3669 Terminal Annex (Res., 943 South Plymouth Blvd.), Los Angeles 6, Calif.

HAGEDORN, HECTOR EDMUND (Jun. '37; Assoc. M. '38; M. '45), Chf. Constr. Engr. (Civ.), Corps of Engrs., U.S. Army, Office of the Engr., Headquarters, Base "X," AFWESPAC, Army Post Office 358, Care, Postmaster, San Francisco, Calif.

KERBER, HENRY JOHN (Jun. '38; Assoc. M. '45), Utility Engr., Standard Oil Co. (Ohio), 2 Refinery (Res., 16000 Nelacrest), Cleveland 12, Ohio.

LEE, GEORGE ADDISON (Jun. '35; Assoc. M. '45), Structural Engr., J. Gordon Turnbull, Inc., Cons. Engrs., 2630 Chester Ave. (Res., 12434 Castlewood Ave.), Cleveland, Ohio.

MEHTA, RAMESH SUMANT (Jun. '37; Assoc. M. 39; M. '45), San. and Irrig. Engr., Public Works Dept., Takhteswar, Bhavnagar, Kathiawed, India.

MITCHELL, STERLING ROSS (Assoc. M. '35; M. '45), Maj., Corps of Engrs., U.S. Army; 3101 Louisville St., El Paso, Tex.

MOORMAN, ROBERT BURRUS BUCKNER (Jun. '29; Assoc. M. '35; M. '45), Prof., Civ. Eng., College of Eng., Univ. of Missouri, Columbia, Mo.

MYERS, HARRY EDWARD (Assoc. M. '44; M. '45), Prin. Asst., J. B. Converse & Co., Inc., Box 1084, Mobile 6, Ala.

NELSEN, LAVERN JAMES (Jun. '36; Assoc. M. '45), Archt. and Structural Designer, J. C. Goodeyne, Room 417 Bay City Bank Bldg., Bay City, Mich.

OSTERBERG, JOHJ OSCAR (Jun. '37; Assoc. M. '45), Asst. Prof., Civ. Eng., Technological Inst., Northwestern Univ., Evanston, Ill.

PATCH, MARSHALL ARTHUR (Jun. '37; Assoc. M. '45), Capt., Corps of Engrs., U.S. Army; Box 493, Goodyear, Ariz.

PLANAS Y VALDES, JUAN IGNACIO (Jun. '37; Assoc. M. '45), Insp. Engr., Ministry of Public Works (Res., Steinhart y Robau, Marianao), Havana, Cuba.

PRICE, THOMAS MALCOLM, JR. (Jun. '30; Assoc. M. '39; M. '45), Comdr., CEC, U.S.N.R.; Public Works Officer, Naval Air Station, Lakehurst, N.J.

ROSEBRAUGH, VERNON HART (Jun. '38; Assoc. M. '45), 7020 North East Everett, Portland, Ore.

SHAPIRO, SIDNEY MATTHEW (Assoc. M. '32; M. '45), Deputy Chf. Engr., Long Island State Park Comm., Babylon, N.Y.

SHEA, JOSEPH THOMAS (Assoc. M. '37; M. '45), Building Commr., City of Boston, 901 City Hall Annex, Boston, Mass.

VERPILLOT, EMIL ALEXANDER (Assoc. M. '37; M. '45), Capt., CEC, U.S.N.R., Alaska Div., Bureau of Yards and Docks, 622 Exchange Bldg., Seattle 14, Wash.

WERNER, GUSTAVE GEORGE, JR. (Assoc. M. '38; M. '45), Comdr., CEC, U.S.N.R.; Care, Malcolm Pirnie, 25 West 43d St., New York 18, N.Y.

WILLIS, LOVELL (Jun. '33; Assoc. M. '45), Management Engr., Du Pont Co., R. and M. Program, Remington Arms Co., Bridgeport, Conn.

WILSON, ROBERT EUGENE (Jun. '39; Assoc. M. '45), Lt. (jg), D-V(S), U.S.N.R.; 4240 Sunken Court, Port Arthur, Tex.

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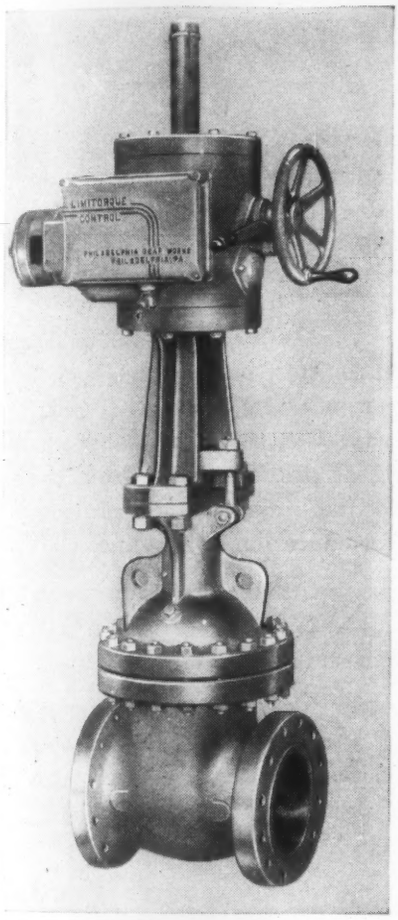

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The Type "SM" Limitorque Valve Operator (shown at left) is designed especially for valves working at low to medium temperatures, low to high pressures, and normal speed of operation.

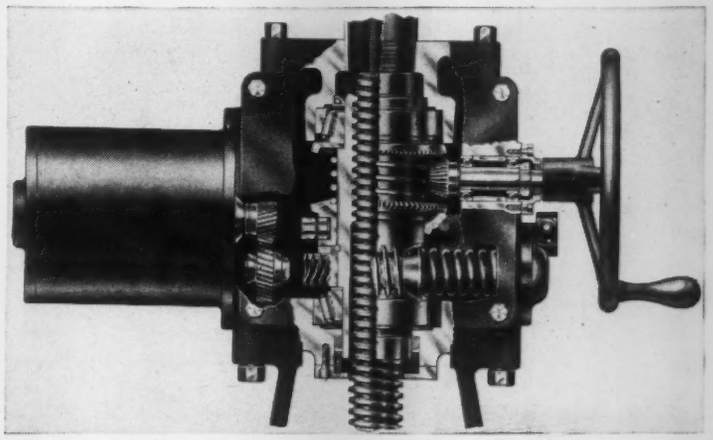
This Unit is mounted on top of valve yoke . . . no extra gears, nuts or bearings required. Stem nut is inside and furnished with Limitorque Unit. Nut is directly inside worm gear which drives it. (All clutches and connecting sleeves are eliminated.)

The Limitorque is designed for plug, cock, gate and globe valves. . . . Entire Unit and nut can be lifted off valve yoke, by removing flange bolts, and without disturbing wiring.

A special high starting torque motor, reduction gears, limit switches are all in one weatherproof assembly, — and all electrical connections are made to one terminal board, easily accessible by removal of watertight cover. . . . Heat treated helical gears and hardened, ground and polished worm and bronze worm gear are used.

A handwheel is provided for manual operation and does not revolve during motor operation. During hand operation motor is mechanically disengaged. The Limitorque is always operative electrically. There is no danger to operator should he be turning handwheel when motor is started, since automatic clutch disengages handwheel instantly, without shock. Declutch lever changes from motor to hand operation. The usual Limitorque "hammerblow" device allows motor to reach full speed before load is engaged. This imparts the "hammerblow" necessary to unseat sticking valve.

Torque seating switch insures tight valve closure without strain on valve parts. Protection from damage due to a foreign object obstructing closing is provided, because motor is shut off by thrust exerted on valve disc. Valve is protected during entire closing operation.



Motor is coupled to worm shaft through helical gears. In closing, worm drives worm gear until lugs on the gear meet matching lugs on clutch. Torque is transmitted to the nut through splines connecting the clutch to stem nut. Torque spring is then compressed by axial movement of worm on worm shaft. When torque spring has been compressed to predetermined setting, torque switch is actuated by a tripping collar on worm shaft. This interrupts current to holding coil of controller and stops motor. Inertia of motor is absorbed in further compression of the torque spring. Opening travel is governed by geared limit switch.

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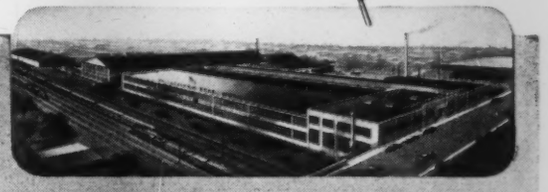

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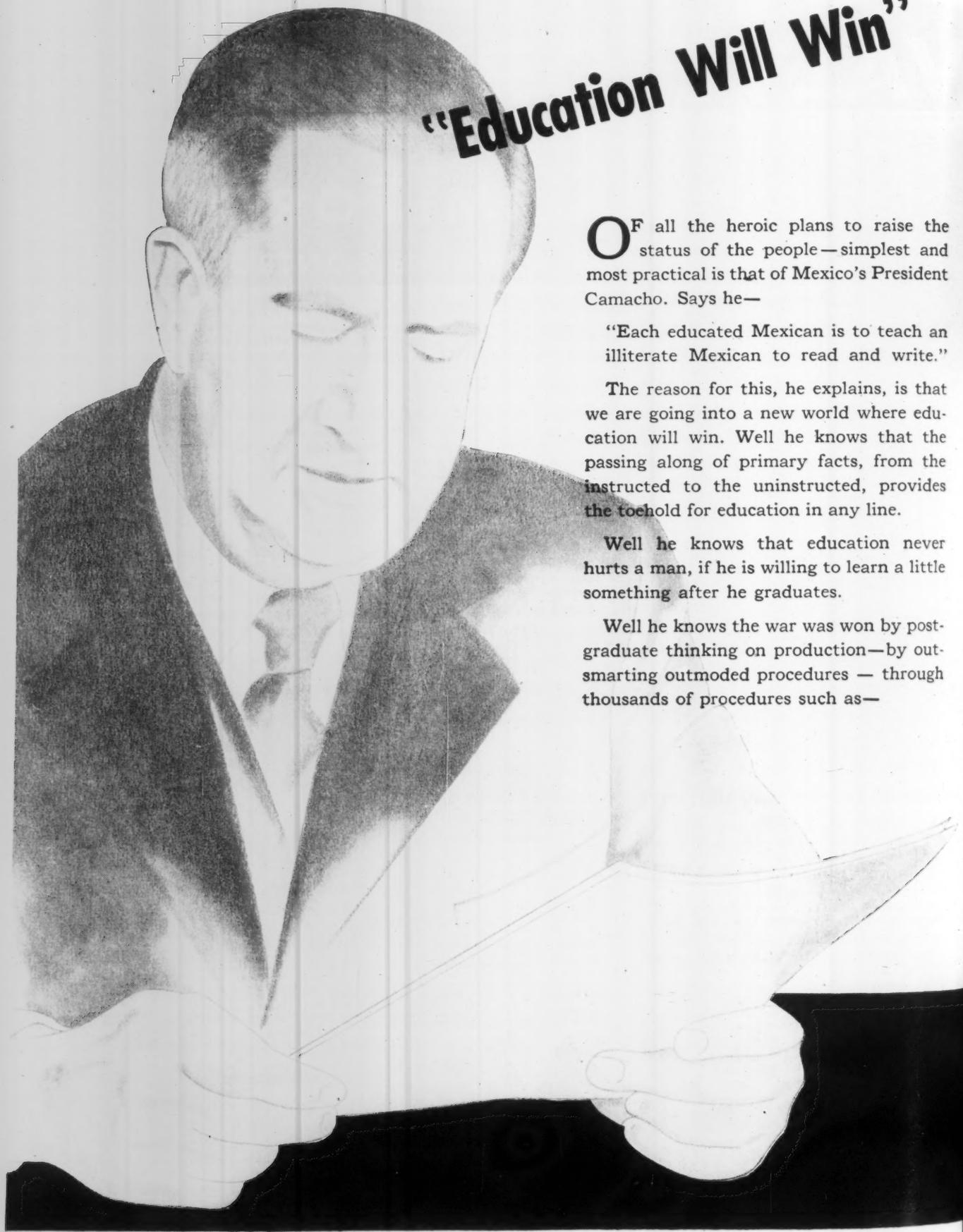
LimiTorque Valve Controls

then he said to himself:

"Education Will Win"



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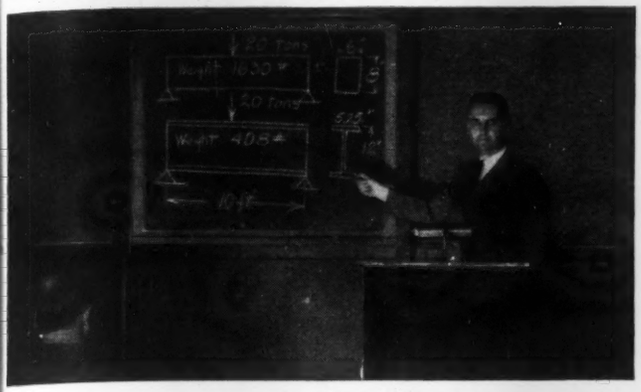

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Applications for Admission or Transfer

Condensed Records to Facilitate Comment from Members to Board of Direction

JANUARY 1, 1946 NUMBER 1

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years RCM*
Associate Member	Qualified to direct work	27 years	8 years	1 year RCA*
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years RCM*

* In the following list RCA (responsible charge—Associate Member standard) denotes years of responsible charge of work as principal or subordinate, and RCM (responsible charge—Member standard) denotes years of responsible charge of IMPORTANT work, i.e., work of considerable magnitude or considerable complexity.

APPLYING FOR MEMBER

BENNETT, PRESTON THEODORE, Omaha 6, Nebr. (Age 41) (Claims RCA 4.2 RCM 6.4) April 1930 to date with U.S. Engrs., at present as Senior Engr.

BOOP, WARREN CLARK, Knoxville, Tenn. (Age 42) (Claims RCA 5.4 RCM 7.9) Aug. 1934 to Jan. 1943 and Aug. 1945 to date with TVA, since Aug. 1945 as Office Engr. V; in the interim Capt. in U.S. Marine Corps Reserve.

BURGHARDT, KING, Denver, Colo. (Age 48) (Claims RCA 9.4 RCM 10.0) June 1944 to date Highway Bridge Engr., U.S. PRA, Denver, since July 1945 being Dist. Bridge Engr. for Colorado; previously Structural Designer, Stearns-Roger Mfg. Co., Denver; Structural Engr., Smith, Hinchman & Grylles, Archts. for Denver Ordnance Plant; Structural Designer, Bridge Dept., Colorado Highway Dept.

CAREY, HOMER FRANK, Bethesda, Md. (Age 49) (Claims RCA 7.6 RCM 13.5) June 1938 to date with U.S. War Dept., since Nov. 1941 as Prin. Structural Engr., and Chf. of Structures Branch.

COLE, REUBEN ECHOLS, Albuquerque, N.Mex. (Age 40) (Claims RCA 3.9 RCM 9.9) June 1926 to date with Corps of Engrs., U.S. Army, at present as Lieut. Col., and since May 1943 serving as Dist. Engr.

CUNNINGHAM, ALBERT HENRY, Storm Lake, Iowa. (Age 59) (Claims RCA 3.9 RCM 32.2) March 1911 to date with Buena Vista County, Iowa, since 1913 as County Engr.

FIELD, MELVIN PRINCE, Houston 4, Tex. (Age 38) (Claims RCM 10.6) June 1939 to date Chf. Structural & Maintenance Engr., Anderson Clayton & Co., and Gulf Atlantic Warehouse Co.

FLICKINGER, LLOYD HENRY (Assoc. M.), Minneapolis, Minn. (Age 41) (Claims RCA 2.4 RCM 1.3) Aug. 1941 to date with Corps of Engrs., U.S. Army, since June 1944 as Major; previously Structural Designer, The Panama Canal, Balboa, C.Z.; with PWA.

GILES, WILLIAM HUGHES, St. Louis, Mo. (Age 54) (Claims RCA 14.0 RCM 8.9) Aug. 1914 to date with Missouri-Pacific Lines, St. Louis, Mo. in various capacities, since Feb. 1937 being Engr. of Design.

GRESSITT, JOHN LYELL, Philadelphia, Pa. (Age 58) (Claims RCA 11.4 RCM 19.0) July 1919 to date with Pennsylvania R.R. in various capacities, since Feb. 1943 as Chf. Engr.

HARKER, DAVID HENDLEY, Indianapolis, Ind. (Age 44) (Claims RCM 20.1) July 1945 to date Chf. Engr., Indiana Flood Control & Water Resources Comm., Indianapolis, Ind.; previously Chf. of Staff, Ohio Water Supply Board, Columbus, Ohio; Land drainage representative, Agricultural Extension Service, Purdue Univ.

HATTON, HANNIBAL SANFORD, Dallas, Tex. (Age 59) (Claims RCA 11.2 RCM 17.5) Oct. 1942 to date Superv. Engr., Reconstruction Finance Corporation, Dallas, Tex.; previously Supt. of Constr., J. G. White Eng. Corporation; Civ. Engr. and Gen. Supt. of Constr., Constr. QM. of Army.

HENEGAR, HERBERT BENTON, Copperhill, Tenn. (Age 54) (Claims RCA 12.5 RCM 15.9) 1930 to date Chief Engr. Tennessee Copper Co., Copperhill, Tenn.

HUGHES, CHESTER ARTHUR, St. Paul, Minn. (Age 50) (Claims RCA 6.0 RCM 12.2) 1927 to 1942 and 1945 to date Associate Prof. of Structural Eng., Univ. of Minnesota; in the interim as Lieut., Captain, and Major, Royal Canadian Engrs.

JOHNSTON, CHARLES TAUTPHAUS, Arcadia, Calif. (Age 42) (Claims RCA 6.3 RCM 6.4) Oct. 1942 to date with U.S. Engr. Office, Los Angeles, Calif., since March 1945 being Res. Engr.; previously with Los Angeles County Flood-Control Dist., in various capacities, finally as Investigation Engr.

JONES, FORREST EMORY, Neodesha, Kans. (Age 53) (Claims RCA 4.1 RCM 25.8) July 1942 to date with U.S. Army, at present as Lieut. Col.; previously Asst. Engr., Missouri Public Service Comm.

MARRA, JAMES VINCENT (Assoc. M.), Long Island City, N.Y. (Age 40) (Claims RCA 10.5 RCM 6.3) July 1927 to date with City of New York, since Aug. 1939 as Civ. Engr., Bureau of Sewage Disposal Design, Dept. of Public Works.

MARTIN, FELIX JOSEPH, St. Louis, Mo. (Age 41) (Claims RCM 15.9) 1929 to date with Mississippi River Fuel Corporation, St. Louis, Mo., since 1942 being Chf. Engr.

PEERSON, JOHN WILLIAMS, Chattanooga, Tenn. (Age 42) (Claims RCA 8.3 RCM 7.8) Sept. 1945 to present member of firm, Schmidt & Peerson, Engrs., Chattanooga, Tenn.; previously with TVA in various capacities, finally as Asst. Constr. Engr.

RODOLF, FRED W., Portland, Ore. (Age 59) (Claims RCA 16.4 RCM 13.6) April 1934 to date Inspector with promotions to U.S. Engr. P-4, Portland.

ROSS, JOHN GERALD, Long Beach, Calif. (Age 36) (Claims RCA 3.3 RCM 5.2) Oct. 1940 to date Officer, CEC, USNR, at present being Commdr., since March 1945 being Public Works Officer, Marine Corps Air Station, El Centro, Calif.

ST. CLAIR, WILLIAM THADDEUS (Assoc. M.), Oak Ridge, Tenn. (Age 41) (Claims RCA 3.7 RCM 9.0) June 1942 to date with Corps of Engrs., U.S. Army, since May 1943 Major; previously Asst. Structural Engr., Whitman, Requardt and Smith, Huntsville, Ala.; Engr. (private practice), Nashville, Tenn.

SAWYER, PERCY, Chicago, Ill. (Age 68) (Claims RCA 7.0 RCM 30.0) 1945 with Consoer, Townsend & Associates, Chicago; previously with Harvey S. Pardee & Associates, Chicago; with Universal Oil Products Co., Chicago; with Lummus Co., Syracuse, N.Y., being Engr.-in-Charge; short engagements with Cons. Engrs.

SCOTT, EDWIN FOX, Christchurch, New Zealand. (Age 47) (Claims RCA 18.3 RCM 7.5) 1924 to 1941 and 1944 to 1945 with Christchurch Drainage Board, since 1944 as Deputy Engr. In the interim, Major, New Zealand Engrs., commanding 36th Army Troops Co.

SCURR, KENNETH RUSSELL, Pierre, S.Dak. (Age 49) (Claims RCA 3.0 RCM 9.9) March 1920 to Nov. 1940 and Sept. 1945 to date with Bridge Dept., South Dakota Highway Comm., Pierre, S.Dak., finally as Bridge Engr.; in the interim Lieut. Col., U.S. Army.

SEAVY, HANSFORD PAUL, Tulsa, Okla. (Age 40) (Claims RCA 8.1 RCM 10.9) Sept. 1923 to date with U.S. Engrs. since 1942 in Corps. of Engrs., U.S. Army, at present as Major.

STANLEY, ARTHUR EMMONS (Assoc. M.), Pacific Beach, Calif. (Age 37) (Claims RCA 2.3 RCM 6.8) Aug. 1939 to date member of firm, Stanley Eng. Co., since March 1942 (on leave) with U.S. Army, at present being Lieut. Col., Air Corps.

TRACY JAMES BENDEL, Muscatine, Iowa. (Age 46) (Claims RCA 4.0 RCM 16.5) Dec. 1942 to date Office Engr. and at present Contact Engr., Stanley Eng. Co., Muscatine, Iowa; previously Head of Estimating Dept., Perkins, McWayne & Stanley Eng. Co., Sioux Falls, S.Dak.; Bid Analyst, Weitz, McLaughlin, Central Eng. & Priestor, Des Moines, Iowa; Project Supt., USDI and USDA, SCS.

WIGGINS, RALPH RAYMOND (Assoc. M.), Cucuta, Colombia. (Age 66) (Claims RCA 13.8 RCM 19.5) April 1945 to date Chf. Engr., Colombian Petroleum Co., Colombia; previously Senior Material Analyst, Foreign Div., PAW, Washington, D.C.; Field Engr., Res. Engr., and Dist. Engr., Creole Petroleum Corporation, Venezuela.

WILLIAMS, STEPHEN MILLER, JR., Tulsa, Okla. (Age 58) (Claims RCM 30.01). 1909 to 1928 member of firm, Williams Brothers, 1928 to 1936 Pres., Williams Brothers, Inc., and 1936 to date Pres., Williams Brothers Corporation.

WOOD, STANLEY, New York City. (Age 52) (Claims RCM 17.8) 1923 to 1930 and 1938 to date Field Engr., The Pitometer Co., in the interim with U.S. Coast & Geodetic Survey.

ZIEBOLD, HAROLD OSCAR, St. Louis, Mo. (Age 39) (Claims RCM 10.1) 1936 to date with Mississippi River Fuel Corporation, St. Louis, Mo., at present as Asst. Chf. Engr.

APPLYING FOR ASSOCIATE MEMBER

ABBEY, CHESTER EDWARD (Junior), Chicago, Ill. (Age 34) (Claims RCA 4.6) Feb. 1944 to date Lieut., CEC, USNR; previously with James Stewart Corporation, Chicago; with Constr. Div., Office of Q.M. Gen., Washington, D.C.

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Columbus	Main 3420	Jacksonville	5-2166	New York	Wis. 7-7678	San Francisco	Dou. 5975		

ABEYTE, ABRAN, Fort Worth, Tex. (Age 29) (Claims RCA 3.7) April 1942 to date with CAA; since April 1943 as Associate Airways Engr. previously with New Mexico Highway Dept.

AYRE, ROBERT STEVENSON (Junior), Monticello, Ill. (Age 33) (Claims RCA 2.1 RCM 1.4) June 1942 to date Mech. Engr., Naval Ordnance Laboratory, Navy Yard, Washington, D.C.; previously Instructor in Mechanical Eng., Stanford Univ.; Instructor in Civil Eng., Oregon State Coll.

BARNWELL, REGINALD HUNTINGTON, Berkeley, Calif. (Age 51) (Claims RCA 7.6 RCM 6.1) April 1934 to date with California Div. of Highways, at present as Asst. Highway Engr.

BAUKOL, PHILIP JULIN, Berkeley, Calif. (Age 45) (Claims RCA 12.2 RCM 1.1) Jan. 1940 to date Mech. Engr., The Austin Co., Oakland, Calif.; previously Structural Draftsman, Permanente Cement Co., Oakland, Calif.

BELCHER, GLENN THEODORE, Honolulu, Hawaii (Age 42) (Claims RCA 14.1) Nov. 1933 to date with U.S. Engrs., since July 1942 as Civ. Engr.

BUECHELER, WILLIAM GOTTLOB, Jacksonville, Fla. (Age 51) (Claims RCA 17.7) 1945 Architectural Engr., Reynolds, Smith & Hills; previously with Merrill-Stevens Dry Dock & Repair Co.; Architectural Engr., Public Works, U.S. Naval Air Station, Jacksonville; Chf. Coordinator & Specification Writer, Robert & Co., Atlanta, Ga.; Associate Engr., with John F. Reynolds, Cons. Engr.

BYRNE, THOMAS GORMAN (Junior), U.S. Coast Guard, Ketchikan, Alaska. (Age 34) (Claims RCA 2.5) Dec. 1938 to date with U.S. Lighthouse Service (now U.S. Coast Guard) in various capacities, at present as Asst. Civil Eng. Officer.

CARLSON, HARRY ALBIN, Bryson City, N.C. (Age 34) (Claims RCA 3.0) July 1944 to date Hydr. Engr. (I), U.S. Geological Survey, Water Resources; previously Structural Designer, Office Engineers, Panama Canal; Jun. Engr., Sec. of Surveys, Balboa Heights, C.Z.; Senior Eng. Aide, Metropolitan Dist. Water Supply Comm., Boston.

CHILDS, ELLIOT FULLER, Newtonville, Mass. (Age 37) (Claims RCA 7.7 RCM 2.0) July 1936 to date with U.S. Engr. Office, Boston, Mass., since 1944 as Chief of Hydr. Sec.

COOK, RUDYARD MERWIN, Evanston, Ill. (Age 36) (Claims RCA 4.3) July 1943 to date Lecturer, Dept. of Civ. Eng., Northwestern Univ.; previously Asst. Prof. of Eng. Mechanics, Louisiana State Univ.; Instructor in Civ. Eng., New Mexico State Coll.

DANIEL, ISAAC CRAWFORD, Kansas City, Mo. (Age 43) (Claims RCA 18.0) Dec. 1944 to date Engr. (Hydr.), U.S. Engr. Office, Kansas City, Mo.; previously Associate Sanitarian, U.S. Public Health Service, Atlanta, Ga.; Inspection Engr., with W. Horace Williams Co., New Orleans, La.; Foreman (Constr.) Contractors Pacific Naval Air Bases, Alameda, Calif.; Res. Engr., State Dept. of Baton Rouge, La.; Field Engr., Board of State Engrs., New Orleans, La.

DE FAZIO, PETER GEORGE (Junior), Long Branch, N.J. (Age 34) (Claims RCA 3.5 RCM 3.6) Nov. 1942 to date Lieut. (CEC) USNR, Bureau of Yards & Docks being Company Commdr., U.S. Naval Constr. Bn., Head of Water Dept. for Bn., since Dec. 1944 Maintenance Officer, Bureau of Aeronautics, U.S. Navy; previously Utilities Engr., Post Engr.'s Office, Sea Girt, N.J.; Asst. Civ. Engr. Dist. Engr.'s Office, Albrook Field, Panama, Canal Zone and Q.M.'s office, Fort Monmouth, N.J.

DURHAM, CHARLES WILLIAM (Junior), San Francisco, Calif. (Age 28) (Claims RCA 2.3 RCM 2.3) April 1943 to date with Corps of Engrs., at present as Capt.; previously with Henningson Eng. Co., Omaha, Nebr.; with J. M. Montgomery & Co., Los Angeles, Calif.; with Donald R. Warren, Cons. Engr., Los Angeles.

EVANS, WILLIAM SPEARING (Junior), Shreveport, La. (Age 32) (Claims RCA 1.0 RCM 3.2) Sept. 1945 to date Archt., Shreveport, La.; previously Design Engr. with Tennessee Eastman Corporation, Oak Ridge, Tenn.; Asst. Hydraulic Engr. TVA, Knoxville, Tenn.; Engr. with Neild, Somdal & Neild.

EWING, WESLEY CHARLES (Junior), San Francisco, Calif. (Age 34) (Claims RCA 13.7 RCM 3.3) Sept. 1943 to Dec. 1945 Lieut. (jg) and Lieut., CEC, USNR, 58th NCB. Previously Labor Supt., J. H. Pomeroy & E. W. Heple Co., San Francisco, Calif.; Chief of Party, W. A. Bechtel Co. (Marinship Corporation), Los Angeles, Calif.; Transitman, Johnson, Drake & Piper, Inc., Alameda N.A.S., Calif.; Hydr. Engr., San Francisco Water Dept.

FEREN, JOHN MICHAEL (Junior), South Gate, Calif. (Age 33) (Claims RCA 10.6 RCM 1.0) Aug. 1945 to date Structural Draftsman, and in charge of field surveys, Donald P. Warren Co., Los Angeles, Calif.; previously Eng. Designer, Kistner, Curtis & Wright; with J. Gordon Turnbull and Sverdrup & Parcel, A. & E. Canol Project, Canada & Alaska; Senior Airport Inspector, Engr.-Designer, Howard, Needles, Tammen & Bergendoff; with Bluebonnet Constrs., Waco, Tex.

FISCHER, MERLE EDWARD (Junior), Sacramento, Calif. (Age 35) (Claims RCA 9.8) July 1934 to date with California Bridge Dept.

FLANDRO, ALLAN WOODS, Salt Lake City, Utah. (Age 31) (Claims RCA 2.5 RCM 6.4) Aug. 1941 to date with U.S. Army, since Feb. 1942 as Capt.; previously with U.S. Dept. of Agriculture.

FUTRAL, ALLEN ASHLEY (Junior), Atlanta, Ga. (Age 34) (Claims RCA 4.0) Aug. 1940 to date with CAC. U.S. Army, at present as Lieut. Col.; previously with U.S. Engrs.

GLASS, SHERMAN (Junior), Brooklyn, N.Y. (Age 30) (Claims RCA 3.9) Aug. 1943 to date Lieut. (j.g.), CEC, USNR, being Asst. Dock Control Officer, Asst. Maintenance Officer, and Div. Officer; previously Asst. Engr. and later Liaison Engr. with Frederic R. Harris, Cons. Engr., New York City; Eng. Asst., Grade 3, New York City Tunnel Authority.

GREEN, ALFRED RICE, Charlottesville, Va. (Age 42) (Claims RCA 5.6) 1929 to present with U.S. Geological Survey, Charlottesville, Va., since 1942 as Associate Hydr. Engr.

GREEN, SHERMAN BALDWIN, Seattle, Wash. (Age 45) (Claims RCA 12.3) Oct. 1942 to date with Corps of Engrs., War Dept., Seattle Wash., since May 1944 as Associate Engr., Civil Works Branch, Seattle Dist.; previously Chf. Land Buyer, Bonneville Power Administration; Engr.-Appraiser, Federal Land Bank of Spokane.

GRIFFIN, WILLIAM COMER, Montgomery 5, Ala. (Age 32) (Claims RCA 3.4) Sept. 1938 to date with Water Resources Branch, U.S. Geological Survey, Montgomery Dist., since July 1942 as Asst. Hydr. Engr.

HALL, GERALD D., Yakima, Wash. (Age 50) (Claims RCA 3.0 RCM 22.9) Aug. 1935 to date in private practice, Yakima, Wash., on work, such as water works, irrigation, docks and railroads, sewerage, sewage treatment, airports, utilities, etc.

HARRELL, WESLEY LEE, Houston, Tex. (Age 32) (Claims RCA 5.7) March 1941 to Feb. 1942 and Feb. 1945 to date Chf. Field Engr., Brown & Root, Inc., Houston; in the interim Chf. Field Engr., Brown Shipbuilding Co., Inc., Houston; previously Contr.'s Engr., Marshall Ford Co., Austin, Tex.

HARTUNG, THEODORE BERNARD (Junior), Philadelphia, Pa. (Age 34) (Claims RCA 3.5 RCM 3.1) Oct. 1942 to date Engr., U.S. Maritime Comm., Philadelphia Constr. Office; previously Structural Contr., Philadelphia.

HATCH, GEORGE EDWIN (Junior), Honolulu, Hawaii. (Age 32) (Claims RCA 4.4 RCM 0.6) Jan. 1943 to date with U.S. Engr. Dept., Honolulu, Hawaii, since Sept. 1945 as Engr., previously Jun. Engr. and Asst. Engr., with U.S. Bureau of Reclamation.

HEGE, WILLIAM DAVID, Salinas, Calif. (Age 37) (Claims RCA 5.0 RCM 2.3) Mar. 1944 to date Chf. Inspector and Asst. Materials Engr., S. Birch & Sons Constr. Co. & Morrison-Knudsen Co., Inc., Seattle, Wash.; previously with California Div. of Highways.

HENSHAW, LAMOND FORBES, Portland, Ore. (Age 36) (Claims RCA 8.1 RCM 3.2) Sept. 1945 to date Vice-Pres., Fischbach & Moore, Inc.; previously General Supt. and Production Mgr. of Shell Plant, Kaiser Industries; Member of Operating Comm., Brewster Aeronautical Corporation, New York City; Design Engr., Swan Island Tanker Yard, Kaiser Co., Inc.; Progress Engr., Oregon Shipbuilding Corporation.

HERMAN, BRUCE ALFRED (Junior), New York City. (Age 33) (Claims RCA 4.9 RCM 1.1) April 1941 to date with Corps of Engrs., U.S. Army, at present as Major; previously Designer, J. E. Greiner Co., Cons. Engrs., Baltimore, Md.

HORDER, JOHN STEPHENS, Corpus Christi, Tex. (Age 34) (Claims RCA 6.5 RCM 4.6) April 1941 to present with U.S. Navy, at present as Commdr., CEC, USNR, being Executive Asst. to Public Works Officer, U.S. Naval Air Station, Corpus Christi, Tex.

HOUSNER, GEORGE WILLIAM (Junior), Pasadena, Calif. (Age 35) (Claims RCA 3.5 RCM 2.5) Nov. 1945 to date Asst. Prof. of Applied Mechanics, California Inst. of Technology; previously Operations Analyst, AAF; with Div. 2 of NDRC at Princeton Univ.; Engr., U.S. Eng. Dept., Los Angeles, Calif.

JOHNSON, EMORY EMANUEL (Junior), Lawrence, Kans. (Age 31) (Claims RCA 3.0) July 1943 to date Asst. Prof. of Civ. Eng., Univ. of Kansas; previously with South Dakota State Coll. as instructor in, and later Asst. Prof. of Civ. Eng.; Instructor in Math., Missouri School of Mines and Metallurgy.

KEREKES, GEORGE JOHN, San Francisco, Calif. (Age 46) (Claims RCA 11.5 RCM 10.3) Sept. 1945 to date Structural Engr., Donald R. Warren Co., San Francisco, Calif.; previously Asst. Engr. Public Works Dept., Wellington, New Zealand.

KRASNICK, MAX AARON, Caracas, Venezuela. (Age 41) (Claims RCA 3.1 RCM 3.4) Nov. 1944 to date Res. Engr., Parsons, Brinckerhoff, Hogan & MacDonald, Cons. Engrs., Caracas, Venezuela; previously Asst. Project Mgr. with Jerome A. Utley, Contr., Royal Oak, Mich.; Gen. Supt. Brandon Green Co., Dearborn, Mich.; Asst. Progress Engr., Sanderson & Porter, Pine Bluff (Ark.) Arsenal; Progress Engr., Albert Kahn, Inc., Detroit, Mich.

LACAZE, LEONARD, Little Rock, Ark. (Age 37) (Claims RCA 3.7 RCM 4.2) April 1929 to date with U.S. Engr. Office, since Oct. 1943 as Structural Engr. (P-3).

MCALEER, JOHN BERNARD (Junior), Riverside, R.I. (Age 35) (Claims RCA 5.0 RCM 0.9) Aug. 1936 to date with U.S. Engr. Office, Providence, R.I., being Jun. Engr., Asst. Engr., Associate Engr. and (since Jan. 1943) Engr.

MCKENZIE, ANDREW JACKSON, JR. (Junior), San Antonio, Tex. (Age 32) (Claims RCA 2.5 RCM 2.5) Sept. 1945 to date investigating possibilities of, and organizing an Eng. and Constr. Corporation; previously with Corps of Engrs., U.S. Army, finally as Major.

MADSEN, INGVALD ELIAS (Junior), Pittsburgh, Pa. (Age 34) (Claims RCA 4.8 RCM 6.0) Sept. 1945 to date Research and Standards Engr., Association of Iron & Steel Engrs.; previously with Corps of Engrs., U.S. Army, finally as Lieut. Col., being Chf. Eng. Branch, China Burma India Theatre; Research Engr., Fritz Laboratory, Lehigh Univ.

MEZAROS, LESLIE JOSEPH MICHAEL (Junior), West Haven, Conn. (Age 35) (Claims RCA 5.0 RCM 3.0) Aug. 1937 to May 1941 and Oct. 1945 to date Structural Draftsman, New York, New Haven & Hartford R.R.; in the interim with CEC, USNR, finally as Lieut.

MOORE, ALBERT MELVILLE (Junior), Framingham, Mass. (Age 34) (Claims RCA 4.0) Oct. 1935 to date with U.S. Geological Survey, since Jan. 1943 as Asst. Engr.

MORGAN, CHARLES PAGE, Long Beach 6, Calif. (Age 33) (Claims RCA 4.5 RCM 2.3) Oct. 1945 to date Structural Engr., Bldg. Dept., Long Beach, Calif.; previously Associate Structural Engr., Mun. Water & Power Dept., Los Angeles, Calif.; Structural Engr., Dow Chemical Co., Midland, Mich., and (later) Consolidated-Vultee Aircraft, Inc., Downey, Calif.; Stress Analyst A, North American Aviation, Inc., Inglewood, Calif.; Asst. Civ. Engr., U.S. Bureau of Reclamation, Denver, Colo.

NAYMAN, MEHMET ALI TAHSIN, Ankara, Turkey. (Age 37) (Claims RCA 5.0) July 1945 to date Asst. Mgr., Turkiye Bakir Isletmeleri Muessesesi; previously with Turkish Govt., finally as Chf. Engr. at Ankara Headquarters.

NEFF, CYRIL WILLIAM, Parma, Ohio. (Age 46) (Claims RCA 12.9) July 1940 to present Civ. Engr., Ohio Dept. of Highways, Cleveland Planning Office; previously Asst. Engr., Cuyahoga County Engr.'s Office.

NELSON, LEE EDWARD (Junior), Kansas City 5, Mo. (Age 32) (Claims RCA 5.4) Feb. 1937 to date with U.S. Engr. Office, since Dec. 1942 as Asst. Engr. and Engr. (hydraulic) P-3, Kansas City, Mo.

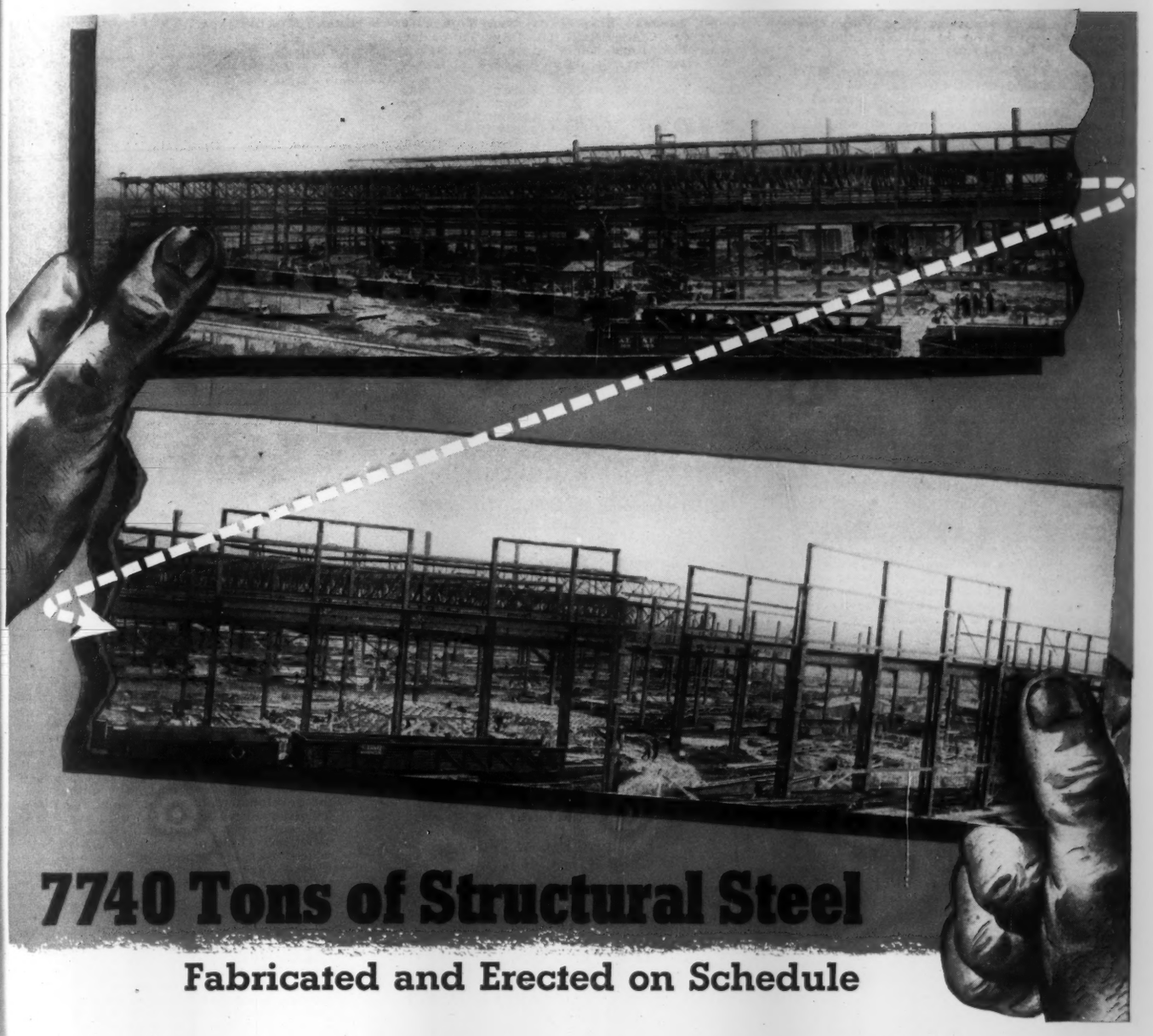
PERCIVAL, ROBERT SHEPARD, Fresno, Calif. (Age 42) (Claims RCA 6.3) Aug. 1930 to date with Dist. VI, California Div. of Highways, since Feb. 1942 as Chf. Draftsman, Civil Service rating Associate Highway Engr.

PINE, EDWARD LEONARD (Junior), Reno, Nev. (Age 31) (Claims RCA 5.7 RCM 1.2) Aug. 1942 to date with Corps of Engrs., U.S. Army, at present as Major, since May 1945 being Officer in Charge overseas U.S. Engr. repair shop for a unit; previously, Asst. Office Engr., Seattle Engr. District and Asst. to City Engr., Reno, Nev.

RAMSEY, JAMES BUTLER (Junior), Kansas City, Mo. (Age 35) (Claims RCA 4.6 RCM 2.1) Nov. 1940 to date with Kansas City (Mo.) Water Dept., at present as Chf. Engr. and Supt.

SANNER, EDWARD REED, Knoxville (17), Tenn. (Age 37) (Claims RCA 1.6 RCM 3.1) July 1945 to date Industrial Engr., Frederic R.

Main 3420 Jacksonville 5-2166 New York Wis. 7-7678 San Francisco Dou. 5975 Wichita 22-7-22



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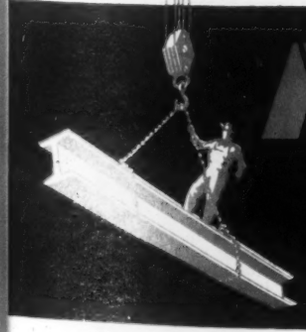

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ENGINEERS
FABRICATORS (75,000 TONS CAPACITY)
ERECTORS

Harris Eng. Corporation, New York City; previously with TVA in various capacities, finally as Industrial Engr.

SCHAEFER, FRANCIS THEODORE, Shakopee, Minn. (Age 32) (Claims RCA 4.6) Jan. 1943 to date with U.S. Naval Constr. Bns., at present as Lieut., CEC, USNR, on terminal leave; previously with Water Resources Branch, U.S. Geological Survey, finally as Asst. Hydr. Engr.

SHUKRY, AHMED, Cairo, Egypt. (Age 33) (Claims RCA 2.5) Nov. 1937 to date member of Faculty of Eng., First Fouad Univ., Giza, Egypt.

SIELKE, ALAN LEONARD, New York City. (Age 29) (Claims RCA 4.2) July 1937 to date with James Stewart & Co., Inc., since July 1943 as Engr.

SMITH, WALDO WOODROW (Junior), Providence, R.I. (Age 32) (Claims RCA 6.9) Feb. 1939 to date Structural Engr. and Estimator, Tower Iron Works, Providence, R.I.

TREGONIS, VERNE MILTON, Newport, R.I. (Age 29) (Claims RCA 4.7) Sept. 1941 to date with CEC, U.S. Navy; previously with CAA, Dept. of Commerce Airport Design; with U.S. Engr. Dept.

TRIPP, FRED BOHM, Petoskey, Mich. (Age 39) (Claims RCA 1.8 RCM 0.9) Oct. 1942 to date with CEC, USNR, at present being Lieut. Comdr.; previously Engr., representing A. W. Hodgkiss Co. at Kiuross, Mich., Liaison with War Dept. Engrs., Asst. City Mgr., Petoskey, Mich.

VARGAS, CARLOS GUILLERMO (Junior), Barranquilla, Colombia. (Age 34) (Claims RCA 1.5) April 1945 to date Engr. on erection of power plant for Cia. Colombiana de Electricidad (Ebasco, International Corporation); previously with Empresas Publicas Municipales, Barranquilla, being Engr. of Technical Sec.; Res. Engr. in charge of engineering in Sinu Area; Field Engr. and Surveyor, Socony Vacuum Oil Co. of Colombia.

VAZIFDAR, RUSTOM PIROZSHAW E., Bombay, India. (Age 29) (Claims RCA 4.9 RCM 2.0) Jan. 1942 to date Captain, Corps of Engrs., India; previously Engr., Chief Engr.'s Dept., Bombay Port Trust, Bombay.

VICE, RAYMOND BROWNING, Bryson City, N.C. (Age 33) (Claims RCA 3.6) Nov. 1939 to date with U.S. Geological Survey, since May 1942, as Asst. Hydr. Engr.

WAGNER, FRANCIS VINCENT (Junior), Hermosa Beach, Calif. (Age 29) (Claims RCA 4.4) Aug. 1944 to date Structural Engr., North American Aviation, Inc.; previously Project Structural Engr., Brewster Aeronautical Corporation; Structural Designer with Frederick R. Harris, Cons. Engr.; Eng. Asst., New York City Tunnel Authority.

WARD, GERALD CHARLES, Arlington, Va. (Age 44), (Claims RCM 2.0) 1940 to date, Capt., Major, and at present Lt. Colonel, Army Air Forces; previously Editorial Representative, McGraw-Hill Book Co., New York City.

WARREN, PAUL EDWARD (Junior). Boulder, Colo. (Age 34) (Claims RCA 9.1) April 1944 to date with Corps of Engrs., U.S. Army, since May 1945 as 1st Lieut.; previously with U.S. Bureau of Public Roads (later PRA) as Jun. Highway Engr., Asst. Highway Engr., and Associate Highway Engr.

APPLYING FOR JUNIOR

BOLLS, EDWARD EUGENE, JR., Kansas City, Mo. (Age 27) June 1941 to date with Black & Veatch, Kansas City, Mo., since Feb. 1943 as Civ. Engr.; previously graduate Asst. and graduate student, Texas Agri. & Mech. Coll.

BUTLER, ALLEN GEORGE, Lock Haven, Pa. (Age 28) Sept. 1943 to date as Stress Analyst & Design Engr. Piper Aircraft Corporation, Lock Haven, Pa.; previously a Design Engr. Draftsman and Research Engr., Lukenweld, Inc., Coatesville, Pa.

COLTRIN, GORDON LAWRENCE, San Francisco, Calif. (Age 29) March 1941 to date with Field Artillery, U.S. Army, since Feb. 1945 as Major; previously Senior Engr. Aide, Jun. Highway Engr., California Div. of Highways, Sacramento.

GLEASON, WILLIAM CLARENCE, Hammond, N.Y. (Age 27)(Claims RCA 1.6) Oct. 1942 to date Aircraft Maintenance Eng. Officer, USAAF; previously Jun. Eng. and Prin. Eng. Aide, U.S. Army Engrs., Buffalo, N.Y.: Constr. Eng., Vanguard Constr. Corporation, New York City; Jun. Eng., W. S. Lozier, Inc., Pine Camp, N.Y.

HASPERT, MATHEWS JOSEPH, Baltimore, Md. (Age 30) (Claims RCA 1.2) March 1941 to date Inspector of Ordnance Material for War Dept.; previously Engr., Williams Constr. Co.; Baltimore Testing Engr., Univ. of Maryland.

JAROSZ, EDWARD STANISLAUS, New York City. (Age 29) (Claims RCA 0.6) July 1939 to date with U.S. Engr. Office, since June 1945 as Associate Engr. (Structural), New York Dist.

KYLE, FRANK KENNETH, Kansas City, Mo. (Age 26) (Claims RCA 3.0) March 1945 to date Associate Engr., Burns & McDonnell Eng. Co., Kansas City, Mo.; previously Asst. Engr., U.S. Engrs., Kansas City Dist.; Company Commander, U.S. Army, Corps of Engrs.

MCCLELLAND, BRAMLETTE, Houston, Tex. (Age 25) (Claims RCA 3.5) Dec. 1943 to date Designing Engr., City of Houston, Tex.; previously graduate student and Research Engr., Joint Highway Research Project, Purdue Univ.

PAYAN, CESAR ALBERTO, Manizales, Caldas, Colombia. (Age 25) March 1945 to date with Parsons, Brinkerhoff, Hogan & Macdonald (Bogota) at present as Soil Engr.; previously with Clarke, Rapuano & Holleran as Draftsman.

WILLARD, EDWARD WEBSTER, Joliet, Ill. (Age 25) (Claims RCA 0.7) May 1943 to date with Corps of Engrs., U.S. Army, as Repair and Maintenance Officer, and since March 1945 Asst. Operations Officer and Job Engr. for Engr. Aviation Bn.; previously Instrumentman, Stone & Webster Eng. Corporation.

1941 GRADUATE

AGRI. & MECH. COLL. OF TEX.
(B.S. in C.E.)

	Age
KEESE, CHARLES JOSEPH, JR.	(26)

1942 GRADUATE

N. Y. UNIV.
(B.C.E.)

HOLT, ARTHUR W. (27)

1943 GRADUATE

MISS. STATE COLL.
(B.S. in C.E.)

HUTCHINS, JAMES GORDON, JR. (24)

1945 GRADUATES

UNIV. OF CALIF.
(B.S. in C.E.)

KILKENNY, PAUL EDWARD (21)

(M.S. in C.E.)

CLYDE, NED PACKARD (24)
(Also 1942 B.S., Utah State Agri. Col.)

CASE SCHOOL OF APPLIED SCI.
(B.S. in C.E.)

DIEMER, WILLIAM DAVID (21)

COLUMBIA UNIV.
(B.S. in C.E.)

KOLLMAR, ROBERT BERNARD (20)
LINDSAY, NORMAN LATSON (20)

UNIV. OF ILL.
(B.S. in C.E.)

BROWN, WILLARD HULL (20)
CARTER, PAUL LEWIS (20)
CHEEK, WALTER DOUGLAS (22)
KONSTANT, ANTHONY NICHOLAS (20)
WARD, RAYMOND CALVIN (20)

IOWA STATE COLL.
(B.S. in C.E.)

COMANN, DAVID HENRY, JR. (20)
HANSEN, WAYNE SIMMONDS (23)
ROBINSON, WILLIAM HAROLD (20)

LEHIGH UNIV.
(B.S. in C.E.)

LINDHOLM, CORNELIUS, JR. (20)

UNIV. OF MICH.
(B.S. in C.E.)

BALD, ROBERT EDMUND (22)
SCOTT, VERNE HARRY (21)

NORTHWESTERN UNIV.
(B.S. in C.E.)

BLEVINS, RALPH WALLACE (22)

CRANE MORTON JACK (20)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

RECENT BOOKS

New books donated by the publishers and filed in the Engineering Societies Library, or in the Society's Reading Room. Notes regarding books are taken from the books themselves, edited by the staff of the Society or of the Library. Books in the Library may be borrowed by mail by Society members for a small handling charge.

PLANNING YOUR HOME FOR BETTER LIVING. By Clarence W. Dunham and Milton D. Thalberg. McGraw-Hill Book Company, Inc., New York, 1945. 278 pp., illus., drawings, and floor plans, 10 × 7 in., cloth, $4. An interesting and informative volume on what the average home owner should know before he decides to buy or build a home. The book breaks down the construction into simple elements that are easily understood, so the prospective owner will be able to obtain exactly what he needs and wants. Special emphasis is placed upon the planning and thinking that should precede construction or purchase, in order to save money and secure the maximum in comfort and effect.

SCIENTIFIC SOCIETIES IN THE UNITED STATES. By R. S. Bates. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 246 pp., tables, 8¾ × 5½ in., cloth, $3.50. The history and the influence of the scientific societies of the United States are the themes dealt with in this book. Beginning with the first small, short-lived organizations prior to the American Revolution, the author traces the development of this grouping together for scientific advancement down to the present-day multitude of national, state, and local societies. These developments are effectively related to other aspects of the growth of the United States. A thirty-page bibliography provides further material on all phases of the subject.

STRENGTH OF MATERIALS, 4 ed. By A. P. Poorman. McGraw-Hill Book Co., New York and London, 1945. 339 pp., illus., diagrs., charts, tables, 8½ × 5¼ in., cloth, $3. This standard textbook is intended for use in undergraduate courses in mechanics, and a knowledge of the principles of physics, the calculus, and statics is assumed. The first two chapters cover the general topics of stresses and strains in tension, compression, and shear. The rest of the book deals with shear and moment in beams, stresses, and deflections in beams, columns, riveted and welded joints, and resilience in bars and springs. Material on aluminum, duralumin, and magnesium columns has been added in the new edition, with new problems throughout.

TABLE OF ARC SIN X prepared by the Mathematical Tables Project, conducted under the sponsorship of the National Bureau of Standards; present volume begun under the auspices of the Work Projects Administration for the City of New York. L. J. Briggs and A. N. Lowan, Directors. Published by Columbia University Press, New York, 1945. 121 pp., tables, 10¾ × 7¼ in., cloth, $3.50. This present table of 12-place values of Arc sin x, in radian measure, may be regarded as a companion volume to the previously published Table of Arc tan x. The function is tabulated at intervals of 0.0001 in the range between 0 and 0.9890, and at intervals of 0.00001 in the range between 0.98900 and unity. A few useful auxiliary tables are included.

THEORY OF STRUCTURES. By S. Timoshenko and D. H. Young. McGraw-Hill Book Co., New York and London, 1945. 488 pp., diagrs., charts, tables, 9 × 6 in., cloth, $5. The various practical methods of analysis of trusses and frames are shown as a development of the general principles of mechanics. Separate chapters deal with the analysis of statically determinate trusses in one plane, influence lines, space trusses with hinged joints, principles of mechanics preparatory to the analysis of statically indeterminate structures, deflection calculations for trusses, bending of beams and frames, and the theory of arches.

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MEN AVAILABLE

GRADUATE CIVIL AND TRAFFIC ENGINEER; Jun. ASCE, 34; University of Michigan and Harvard Bureau of Street Traffic Research. Major, Field Artillery. Service in F. A. Observation Bn. and Army Transportation Section. Three years as city traffic engineer; insurance and road construction experience. Desires administrative or engineering position in Northeast. C-188.

ENGINEER-EXECUTIVE; M. ASCE; age 44; married; registered; 17 years' experience on design and construction of highways, airfields, sewers; 3 years promotional and sales; coordinating and trouble shooting a specialty. Engineer officer for 3 years—two years overseas. Immediately available for executive position in promotion or sales with equipment manufacturer, contractor, or municipality. Will travel. C-190.

EXECUTIVE ENGINEER; M. ASCE; graduate; registered M.E.; married; 23 years' broad experience in the management, operation, maintenance, design, construction, related engineering, personnel, and public relations of water supply and sewage disposal departments. Presently administrating 25 systems in 7 states. Desire permanent position with municipality, utility, or industry. C-191.

CIVIL ENGINEER; Jun. ASCE; 31; married; experience as assistant instructor, university course surveys and structures; 4 years as promotional and development engineer with steel corporation; 2 years as engineering officer for NCB in Pacific, building air bases; seeks engineering and development job with construction firm. Available in January 1946. C-192.

STRUCTURAL ENGINEER; Assoc. M. ASCE; 38; married; B.S.C.S.; M.S.E.; majored in structures; 12 years' experience on heavy construction—navigation locks, and hydroelectric structures. Experience principally in design of construction plant equipment, but familiar with other phases of office engineering. Available immediately. Location in South preferred, but not essential. Salary open. C-193.

SOILS ENGINEER; Assoc. M. ASCE; veteran; graduate C.E.; 35; 10 years' experience in laboratory testing, design, research, field investigations, and construction of earth dams, levees, highways, airfields, building and bridge foundations. Excellent references. Will consider teaching. C-194.

CIVIL ENGINEER; Assoc. M. ASCE; 32; married; graduate of University of Cincinnati; registered Ohio C.E.; 9 years' experience in construction, design, and executive management, including 3½ years as Naval officer in Civil Engineer Corps. Desire permanent position in Ohio, Indiana, or Kentucky in managerial, executive, or sales engineering capacity with large organization. Available immediately. C-195.

MANAGER OR EXECUTIVE ENGINEER; Assoc. M. ASCE; 39; engineering degree; for manufacture, maintenance, construction, design of specialized machinery, equipment and structures. Broad experience fabricating and construction trades. Assume responsibility production, labor relations, engineering, costs, sales, contracts. Now highly placed with top firm. Location, East or South. C-196.

M.I.T. GRADUATE; M. ASCE; allied citizen with 1st American papers; age 45; soon available for executive work in United States or abroad for leading American company. Have been actively engaged in New York, 1940–1944, buying industrial and mining machinery for export. Before the war held leading positions in Europe as designing engineer and as manager of internationally known institute. Am presently completing war assignment abroad. C-197.

CONSULTING ENGINEER; Assoc. M. ASCE; age 36; registered; wide experience in highways, bridges, sewer and water systems, industrial and public building and transportation operations. Desires to associate with a consulting engineer in a developing business. Headquarters preferred in northeastern United States. Last 5 years with CEC, U.S. Navy. Annual income 1940, $7,500 a year. C-198.

CIVIL ENGINEER; Jun. ASCE; graduate; age 29; married; recently discharged from army. One year of experience on construction inspection; 2 years as junior structural engineer in government; 2½ years with Avn. Army Engrs., surveying. Desire work in design office. Salary dependent upon work, location, and future. Available immediately. C-199.

CIVIL ENGINEER; Assoc. M. ASCE; P.E., New York; age 34; 14 years' experience in design and construction, contractor's resident and office engineer on construction of airports, highways, docks, bridges, buildings, and utilities. Experience in estimating, preparation of reports and specifications, and related work. Good executive. Desire permanent position, preferably in the East. Available January 15, 1946. C-201.

CIVIL ENGINEER; M. ASCE; Lehigh University graduate; C.E. and mining and geology degrees. Extensive experience in portland cement plant construction; studies of flood control by means of impounding reservoirs studies; flood control construction; water supply and distribution systems; sewage disposal and stream pollution studies; designs and estimates; steam power plant studies; location in United States or western Canada. C-202.

CIVIL ENGINEER; Jun. ASCE; 30; married; B.S.C.E., 1936; 4½ years as officer in U.S. Navy—experience in personnel and office management, financing of construction contracts, scheduling, purchasing, expediting, stock control, inventorying, warehousing, and exporting construction materials and equipment. Administrative division head—Navy organization. Formerly with government on topographic, flood control, and hydroelectric work. Desires permanent position, preferably on East Coast. C-203.

NAVY LIEUTENANT; Jun. ASCE; 1942 graduate; married, but no children and will travel. Desire position in bridge and building construction, leading to future in structural design. One year's shop and drafting experience in fabricated steel, and surveying experience; 2½ years Naval experience in Aviation Ordnance. Expect discharge approximately March 1, 1946. C-204.

CIVIL ENGINEER; Assoc. M. ASCE; age 36; married; 3 years' experience as superintendent of production department in shipyard—supervised handling of materials and prefabrication scheduling; 7 months as engineer on airport construction; 2 years as office engineer and 6 years as project engineer on road and bridge construction. Salary open. C-205.

NAVAL LIEUTENANT; Jun. ASCE; 25; graduate of University of Connecticut, 1942; married; 3½ years' experience in design, inspection, testing, and construction of ships. Desire position with construction contractor as field engineer.

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PROFESSIONAL ENGINEER, Jun. ASCE; New York State license; 10 years varied experience in hydraulic design, flood control design and reports, building construction, construction safety engineering, and airport design; 2 years, U. S. Navy: pontoon design, construction, operation and instruction; Public Works Officer. Interested in permanent position and future. Salary, $5,000 a year, available January. C-207.

MAINTENANCE AND UTILITY ENGINEER; 35; married; graduate engineer; 4 years on construction and maintenance of airdromes, runways, buildings, roads, grounds, and utilities; 8 years' construction experience with mining companies; 3 years experience as chief engineer. Consultant. Have had several technical articles published. War veteran with good overseas construction record. Desire location in New York City. C-208.

POSITIONS AVAILABLE

ARCHITECT, 45–50, with at least 10 years' experience in community building and industrial plant construction, from both the architectural and structural viewpoint. Should also know the economic side. Salary, $7,600 a year. Location, Delaware. W-6157.

ENGINEERS experienced on storm drainage design, and as draftsmen for municipal corporation. Permanent. Write stating salary desired, experience, and qualifications. Location, Maryland. W-6187.

CIVIL ENGINEER, 32–45, with topographical surveying, sewer and water works construction, and city paving experience, to assist municipal engineer. Must know Spanish. Salary open. Location, Colombia, S.A. W-6202.

CIVIL ENGINEER, young, to lead a survey party in connection with a storage dam. Salary, about $2,500 a year. Location, Nicaragua. W-6258.

ENGINEER CONSTRUCTION AUDITOR. Should have had several years' experience in estimating and supervisory work for a construction or contracting firm. Will audit records and payrolls. Salary, $2,700 a year. Location, New York, N.Y. W-6260.

INSTRUCTOR with interest and advanced training in the sanitary field. Will teach surveying and some work in the field of structures in addition to sanitary courses. Position starts February 10, 1946. Salary, $2,500 a year. Location, Rhode Island. W-6265.

HYDRAULIC OR CIVIL ENGINEER, young, to serve as assistant to director in division of water control. Prefer college graduate with basic training in hydraulics. After training will be required to direct and check field surveys, pass upon water control permits, perform office calculations involving hydraulic and hydrologic problems, assist in planning and supervision of the construction of small dams, ditches, levees, etc. Salary, to start $2,700–$3,000 a year. Location, South. W-6283.

CIVIL ENGINEER, under 35, for the sale and marketing of asphalt for road and street work. Should have had some previous sales experience. Will contact state and county highway departments. Salary, $5,000 a year. Territory, Atlantic seaboard. W-6316.

ENGINEERS. (*a*) Project Engineers fully experienced in architectural design of new, and alterations to, terminal buildings, hangars, shops, and offices. Should have ability to design to specifications buildings and areas, etc. Salary, $3,600–$6,000 a year. (*b*) Assistant Project Engineers, architectural draftsmen who have had some experience in the field of design and alterations of large office buildings, hangars, shops, or office. Salary, $3,420–$3,900 a year. (*c*) Mechanical or Civil Engineers who have had experience on shop, factory, or building layout. Salary, $3,420–$3,900 a year. Location, New York, N.Y. W-6354.

INSTRUCTORS in Civil Engineering. Interested in men whose major work has been in structural, sanitary, hydraulics, or applied mechanics. Position starts March 1, 1946. Appointment, 6 months; possibly permanent. Salary, $300 a month. Location, Texas. W-6364.

FIELD PROMOTION ENGINEER for a trade association, preferably with experience in sewer design, construction, and materials. Salary, $4,000–$5,000 a year. Headquarters, New York, N.Y. W-6377.

CIVIL ENGINEER, young, preferably with some experience in road and highway work for office work in connection with specifications and estimates. Salary, $3,600 a year. Location, northern New Jersey. W-6382.

SALES CONTACT ENGINEER, preferably with some experience in fabricated steel for bridge or building work. Salary open. Headquarters, Pennsylvania. W-6385.

ENGINEER, 26–32, graduate, with at least 4 years' experience, part of which has included surveying and construction, for a large sugar company. Work consists of designing buildings and small structures, land surveys, irrigation, general construction. Permanent; good opportunity. Write stating education, experience, marital status, size of family, and salary expected. Location, Puerto Rico. W-6387.

CIVIL ENGINEER, junior, for office routine work, leading to promotion and sales position in the cement industry. Salary, $2,100 a year. Location, New York, N.Y. W-6388.

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Publications (Except Those of the American Society of Civil Engineers) in this Country and Foreign Lands

Selected items for the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher, or they may be borrowed from the Engineereng Societies Library. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page to members of the Founder Societies (30 cents to all others), plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

CONCRETE, WEST POINT, VA. Deck Bridge Built of Precast T-Beam Units. *Eng. News-Rec.*, vol. 135, no. 16, Oct. 18, 1945, pp. 490–493. Deck of long, reinforced-concrete slab-and-girder highway bridge supported on concrete pile bents is being precast in 40-ft lengths at central yard; 110-ton sections are loaded by gantry crane onto steel barge and floated to desired location, where water is pumped into scow to lower slab into place; to save form lumber and labor, previously poured piles were used as side forms for bents.

FRANCE. France Begins Bridge Reconstruction on Seine and Marne at Paris, W. G. Bowman. *Eng. News-Rec.*, vol. 135, no. 18, Nov. 1, 1945, pp. 572–578. New welded arch over Seine at Paris suburb of Neuilly has span of 269 ft; five 100-ft welded continuous girder spans carry projected Paris-Versailles superhighway over Seine at St. Cloud; structural reinforcement used to support concrete forms in Suresnes Bridge, concrete cantilever of 259-ft main span; other bridges being repaired or replaced.

HIGHWAY, FINANCING. Kentucky Celebrates Freeing of Eight Toll Bridges. *Am. Highways*, vol. 24, no. 4, Oct. 1945, pp. 11, 24–25. Revenue bonds issued by state for construction of bridges were payable solely from tolls collected; construction costs listed; freeing of bridges accomplished 5 years prior to ultimate maturity of bonds.

INDIA-BURMA-CHINA. Suspension Bridges Built for China Pipe Line, P. Reed. *Oil & Gas J.*, vol. 44, no. 24, Oct. 20, 1945, pp. 143–144. In construction of India-Burma-China petroleum products pipe line, steel cable was used extensively; suspension bridges supported line over rivers and streams, and in difficult road crossings; features of 600-ft span over Salween River gorge; other uses of steel cable on construction job.

MILITARY. Combat Engineers—Under Fire, F. J. Sackton. *Military Engr.*, vol. 37, no. 239, Sept. 1945, pp. 354–356. Sketch of operations of 108th Engineer Combat Battalion in Philippines; bridge and road construction and repair.

MILITARY. Rhine River Railroad Bridges, C. R. Moore. *Military Engr.*, vol. 37, no. 239, Sept. 1945, pp. 338–341. Planning, bridge design and construction of pile-type bridges constructed by Army Engineers to carry very heavy rail loads.

MILITARY, CONSTRUCTION. Semi-Permanent Bridge Construction by Canadian Army, J. P. Carriere. *Eng. J.*, vol. 28, no. 10, Oct. 1945, pp. 514–519. Description of planning and construction of two typical bridges and discussion of problems facing military engineer under battle conditions.

NEW YORK. Bridges of New York, O. H. Ammann. *Boston Soc. Civ. Engrs'.,-J.*, vol. 32, no. 3, July 1945, pp. 141–170. Review of design and construction problems encountered in building Brooklyn, Williamsburg, Manhattan, Triborough, George Washington, Bronx-Whitestone, Queensboro, Hell Gate, and Bayonne bridges.

RAILWAY, ONTARIO, CAN. Unique Plan for Remodelling of Large Railway Bridge, C. P. Disney. *Roads & Bridges*, vol. 83, no. 10, Oct. 1945, pp. 65–69, 102. Notes on construction of new bridge of Canadian Nat'l Railways, near St. Catherines, Ont.; use of steel H-piles and "Prepakt" concrete for pier construction permits rebuilding under traffic with great saving in time and cost as compared with diversion and new bridge.

SUSPENSION, TACOMA, WASH. Design of Suspension Superstructure to Replace Former Tacoma Narrows Bridge—I, C. E. Andrew. *Pac. Bldr. & Engr.*, vol. 51, no. 10, Oct. 1945, pp. 45–49. Report on research into aerodynamic forces in relation to bridge design; design and construction of world's first 3-dimensional dynamic model of suspension bridge; tests for stability; more research needed before setting up general design procedure.

TRESTLE. Canadian Universal Trestle. *Eng. J.*, vol. 28, no. 8, Aug. 1945, pp. 498–504. Trestle provides intermediate supports to carry Bailey, Inglis, or small box-girder types of bridges in either wet or dry gap locations; design and construction described.

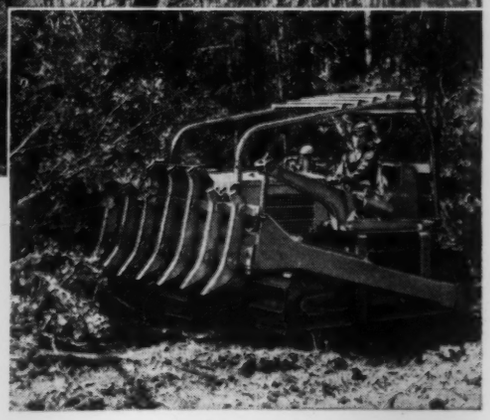
WOODEN. Construction of 220-Ft Timber Bridge, W. A. King. *Pub. Works*, vol. 76, no. 10, Oct. 1945, pp. 25–26. Brief description of construction of timber highway bridge in Shawnee County, Kans.; bridge has total length of 220 ft consisting of one 40-ft wooden truss and nine 20-ft approach spans.

BUILDINGS

BUILDING CODES, UNITED STATES. How Strong Is a "Safe" Building? G. N. Thompson. *Indus. Standardization*, vol. 16, no. 8, Aug. 1945, pp. 173–175. New standard in series of American Standard Building Codes gives designers data on how to determine minimum loads building can carry with safety; brief commentary on American Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures A58.1—1945 issued by Am. Standards Assn.

CONCRETE. Concrete Building Design Trend Shaped by Clear Space Needs, A. J. Boase. *Eng. News-Rec.*, vol. 135, no. 16, Oct. 18, 1945, pp. 530–534. Review of applications of reinforced concrete to unusual conditions which will influence future design; need for clear floor space; flat slab design; thin shell structures; nature of shell stresses; shells strengthened at openings; traveling forms.

CONCRETE, LATIN AMERICA. Some Concrete



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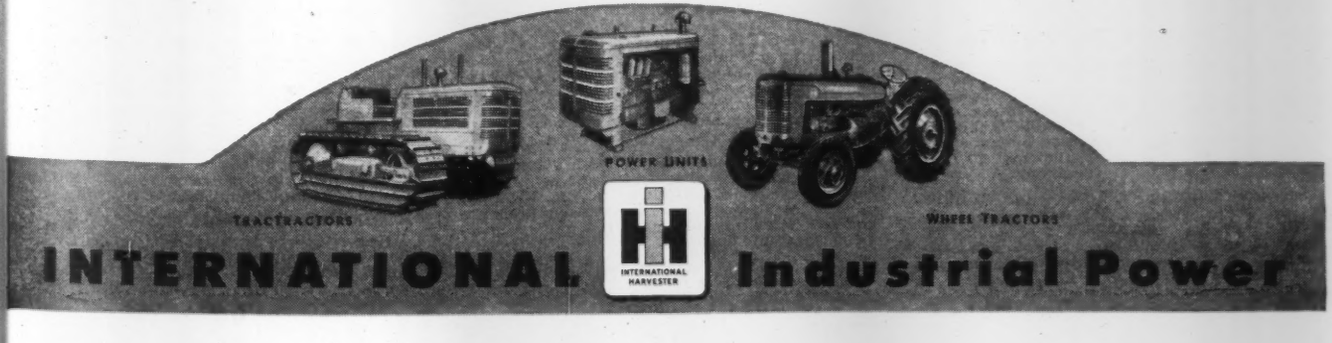

Structures in Latin America. *Concrete*, vol. 53, no. 10, Oct. 1945, pp. 4–6. Types of concrete buildings being constructed are described. Report by office of Inter-American Affairs.

FIRE PREVENTION. Fire Grading of Buildings, R. C. Bevan. *Roy. Inst. Brit. Architects, J.*, vol. 52, no. 11, Sept. 1945, pp. 315–321. Grading of fire precautions in buildings so far as they concern construction and planning of buildings and fire-fighting equipment, to afford adequate standard of safety against fire; fire hazard considered and precautions which should be taken to minimize hazard.

FIRES, UNITED STATES. Disaster Strikes Institutions. *Nat. Fire Protection Assn., Quarterly*, vol. 39, no. 2, pt. III, Oct. 1945, pp. 3–13. Detailed description of nine institution fires; Lacoste Baby Home, Auburn, Me.; Evansville State Hospital for Insane, Evansville, Ind.; Lake Forest Park Sanitarium, Near Seattle, Wash.; Salvation Army Hotel for Transients, Dallas, Tex.; Mission School, Little, Ky.; Federal Transient Bureau, Lynchburg, Va.; Pennsylvania Memorial Home, Brookville, Pa.; Little Sisters of the Poor Home, Pittsburgh, Pa.; Crile Clinic, Cleveland, Ohio.

LIGHTING OFFICE BUILDINGS. Improved Technique in Small Office Lighting, A. W. Larson and W. H. Kahler. *Illum. Eng.*, vol. 40, no. 8, Sept. 1945, pp. 570–582, (discussion) 582–589. Shortcomings of small-office lighting are listed and methods of overcoming them discussed; seeing requirements, problem of glare, brightness distribution, and specific lighting layouts covered.

LIGHTING SCHOOL BUILDINGS. Control of Natural Light in Classrooms, R. L. Biesele, Jr., W. F. Folsom and V. J. Graham. *Illum. Eng.*, vol. 40, no. 8, Sept. 1945, pp. 590–608, (discussion) 608–621. Report of attempts at control of natural lighting in old school building; description of control rooms and remodeled rooms.

MAINTENANCE AND REPAIR. Plant Studies Better Operation of Modern Well-Planned Building, L. E. Kelley. *Power*, vol. 89, no. 10, Oct. 1945, pp. 651–653, 706c. Description of maintenance practices at building of Tiffany & Co., N.Y.; dirt and dust control; use of gravel roof; fire prevention equipment and protection against water damage; air conditioning; machinery records; elevator inspection.

MATERIALS, RECLAMATION. Utilization of Structural Materials from War Emergency Works and Buildings. *Surveyor*, vol. 104, no. 2802, Oct. 5, 1945, pp. 585–586. Circular issued by British Ministry of Health dealing with question of utilization of materials after demolition of shelters, and clearance of war debris and military works.

MODULAR CONSTRUCTION. Cutting Costs with Modular Design, A. G. Lorimer. *Eng. News-Rec.*, vol. 135, no. 16, Oct. 18, 1945, pp. 508–513. Module of 4 in., selected as basic dimensional unit for all building products, serves as spacing for 3-dimensional grid to which building and its components may be referenced; in coordinating products, nominal dimensions are in multiples of 4 in. but allowance is made in actual size for joints.

STEEL. Light-Gage Steel for Peacetime Building, M. Male. *Eng. News-Rec.*, vol. 135, no. 16, Oct. 18, 1945, pp. 525–529. Experience with light-gage steel has brought about establishment of specification for base metal and confirmation of belief that modern types of light steel construction, as commonly used with protective paint applied before erection, can meet all usual requirements of service; specification for design of structural elements of light-gage steel and series of standard shapes under preparation.

CITY AND REGIONAL PLANNING

LONDON, ENGLAND. Greater London Plan. Appreciation, C. W. Craske. *Surveyor*, vol. 104, no. 2800, Sept. 21, 1945, pp. 553–554. Discussion of various aspects of report; proposals for decentralization.

LONDON, ENGLAND. London Re-Development. *Roads & Road Construction*, vol. 23, no. 272, Aug. 1, 1945, pp. 247–248. Plan of Town Planning Committee with respect to roads and traffic.

NEW CONDITIONS. Municipal Planning Should be Attuned to New Conditions, A. E. K. Bunnell. *Water & Sewage*, vol. 83, no. 8, Aug. 1945, pp. 28 and 44. Consideration of fundamental changes in thinking and approach that are necessary to effective planning. Before Am. Water Works Assn.

SALEM, ORE. Long Range Plan for Salem, Oregon, C. B. McCullough. *Pac. Bldr. & Engr.*, vol. 51, no. 9, Sept. 1945, pp. 45–47. Ten phases of activity planned for city include zoned territorial expansion, transportation, public buildings, private developments, parks and playgrounds, utilities, survey of industry, municipal government, finance, and popular education.

VILLAGES AND TOWNS. Town and Country Planning. *Roy. Inst. Brit. Architects—J.*, vol. 52, no. 10, Aug. 1945, pp. 295–299. Planning of villages and towns; standards of living; reconstruction and replanning of existing towns; street planning; control of design. Abstract of report by Reconstruction Committee.

CIVIL ENGINEERING

MILITARY ENGINEERING, GUAM. What Blood and Sweat Have Done at Guam, H. W. Richardson. *Eng. News-Rec.*, vol. 135, no. 10, Sept. 6, 1945, pp. 284–289. Description of work of Corps of Engineers in providing roads, camps, airfields, and harbor improvement.

OKINAWA. Okinawa Was Ready, H. W. Richardson. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 422–429. Account of construction work on Okinawa by joint Navy Construction Battalions and Army Engineer Aviation Battalions; details of road and airport building, waterfront work and water supply undertakings.

CONCRETE

AIRPORT RUNWAYS. Massive Slabs for Southwestern Airfield. *Roads & Streets*, vol. 88, no. 9, Sept. 1945, pp. 102–103. Construction details of concrete service apron and runways; pavement on apron consists of 18-in. concrete of uniform thickness placed on 12 in. of heavily rolled select material base and rolled subgrade.

CONSTRUCTION, SOUTH AMERICA. Construction Practices in South America, A. J. Boase. *Eng. News-Rec.*, vol. 135, no. 10, Sept. 6, 1945, pp. 292–298. Observations on practices; comparison with American practices; use of wood forms; 1:2:4 mix; construction of Volta Redonda steel plant.

EROSION, PREVENTION. Concrete Supplies Permanent Obstacles to Erosion, A. W. Emerson. *Concrete*, vol. 53, no. 7, July 1945, pp. 2–4. Description of concrete structures used for soil conservation; concrete masonry drops; overfall installations.

IRRIGATION CANALS, LINING. Concrete Lining on Yakima Project, C. L. Tyler. *Concrete*, vol. 53, no. 8, Aug. 1945, pp. 12–13, 16, and 19. Illustrated description of placing concrete lining on Yakima Ridge Canal; Kittitas-type side liner used.

PROPERTIES. Studies of Concrete with Entrained Air, D. L. Bloem and S. Walker. *Concrete*, vol. 53, no. 8, Aug. 1945, pp. 36–39. Account of tests and results of investigations of National Ready Mixed Concrete Assn. laboratory on properties of concrete-containing entrained air; effect of entrained air on mixing water requirements.

WATER TANKS AND TOWERS. Prestressed Water Storage Tank in Miami, O. P. Hart. *Concrete*, vol. 53, no. 7, July 1945, pp. 18–19 and 23. Design of tank for pneumatic concrete with prestressed wires for band reinforcement; use of slip joint at base of tank wall.

WATER TANKS AND TOWERS. Two-Way Prestressed Concrete Water Storage Tank, J. R. Carr. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 434–439. New concepts in design and construction of large reinforced concrete water tanks were applied to ¾-mg circular reservoir completed recently at Great Falls, Mont.; in addition to customary horizontal bands of prestressed hoops, the tank employs vertical prestressed steel rods to guard against horizontal cracks from temperature differentials and plastic flow of concrete.

CONSTRUCTION INDUSTRY

MILITARY ENGINEERING. Engineering Operations on Advanced Bases, A. L. Lane. *Military Engr.*, vol. 37, no. 238, Aug. 1945, pp. 299–302. Problems in developing bases include airdrome construction, planning of construction, wharves, water supply, bridges, covered storage, and miscellaneous facilities.

DAMS

CONCRETE ARCH, ARIZONA. Bridge Canyon Dam. *Pac. Bldr. & Engr.*, vol. 51, no. 9, Sept. 1945, pp. 48–50. Design of dam to be 736 ft high, nearly 680 ft wide at base, and 1,950 ft long at crest; highway to be built from rim of canyon to dam site; problems of construction.

CONCRETE, MAINTENANCE AND REPAIR. Skagit Bay Tidegate Repaired, F. K. Muceus. *Western Construction News*, vol. 20, no. 8, Aug. 1945, pp. 100–102. Drainage control channel maintained and salt water intrusion of productive farm lands prevented by emergency repair of tide-gate structure and abutting dikes during period of maximum tide; supporting apron was undermined to such degree that failure was imminent.

CONCRETE, WASHINGTON. Raising Ross Dam to 475-Ft. Height. *Eng. News-Rec.*, vol. 135, no. 12, Sept. 20, 1945, pp. 378–381. Work now under way on dam at upper end of Seattle's Skagit River power development comprises second of four steps in building thin concrete arch to proposed ultimate height of 675 ft; problems of construction; concrete quality control; cooling and grouting systems.

CONCRETE, WASHINGTON. Seattle's Ross Dam —Second Step Under Construction. *Western Construction News*, vol. 20, no. 8, Aug. 1945, pp. 83–88. Discussion of river development program, concrete work on Ross Dam, concrete specifications, aggregate handling.

EARTH, ARIZONA. Arizona Earth and Rock Fill Dam Rising on Site Contemplated Fifty Years Ago, L. L. Lee. *Western Construction News*, vol. 20, no. 9, Sept. 1945, pp. 92–96. Structure under construction on Verde River by Phelps-Dodge Copper Corp. to replace, for irrigation use, water being diverted from Black River 150 miles to east; dam has concrete cut-off wall and spillway; dam crest and spillway apron to be utilized for highway.

EARTH, FOUNDATIONS. Folsom Dam Foundation Explorations, C. J. Gorman. *Western Construction News*, vol. 20, no. 9, Sept. 1945, pp. 101–102. Geologists drive tunnels and shafts into Sierra granite in preconstruction examination of bedrock underlying site of 354-ft earthfill flood-control and irrigation structure on American River; main dam will be 11,500 ft long and excavation will total 21,000,000 cu yd.

MASONRY, RAISING. Heightening Aswan Dam. *Engineer*, vol. 179, no. 4666, June 15, 1945, pp. 464–466. Description of plan to heighten dam for third time to form storage reservoir for major portion of excess waters in great flood, while auxiliary reservoir is to be formed by Wadi Rayan, large depression in desert south of Fayum Province.

SPILLWAYS, DESIGN. Design of Soil Erosion Control Structures, F. W. Blaisdell. *Agric. Eng.*, vol. 26, no. 3, Mar. 1945, pp. 107–108, and 110. Article deals only with those structures that have been studied and are still being studied at St. Anthony Falls Hydraulic Laboratory; these include pipe bleeders, rectangular spillways, flume outlets, culvert outlets as they have been constructed, and new and less expensive type of stilling basin; few additional studies have been made on specific structures. Before Am. Soc. Agric. Engrs.

FOUNDATIONS

BRIDGE PIERS. Deepest Pneumatic Pier Sunk by Kansas City Bridge Company. *Construction Advisor*, vol. 17, no. 8, Aug. 1945, pp. 122–123. Description of construction of pier at Tapock, Ariz.; air pressure of 52 lb per sq in. maintained, since bottom of foundation was 124 ft. 11 in. below water; gantry cranes used on tramway.

DAMS, BUTTRESS. Multiple Grouting of Dam Foundation, L. F. Harza. *Eng. News-Rec.*, vol. 135, no. 10, Sept. 6, 1945, pp. 299–301. Description of "step-grouting" procedure used on foundation of Rincon del Bonete Dam in Uruguay.

DESIGN. Design of Independent Foundations, S. B. Hamilton. *Structural Engr.*, vol. 23, no. 9, Sept. 1945, pp. 403–436. Discussion of general problems and design of centrally and eccentrically loaded pad foundations.

MILITARY ENGINEERING, EXCAVATION. Where There's a Will, R. P. Day. *Excavating Engr.*, vol. 39, no. 8, Aug. 1945, pp. 422–423 and 466. Use of excavating equipment on unusual jobs in Pacific theater; refloating landing ship; scrapers excavate coral; cranes speed Quonset work.

PILE. Stepped Concrete Piles Support 10-Story Wings of Veterans' Hospital, C. S. Strike. *Construction Methods*, vol. 27, no. 9, Sept. 1945, pp. 114–115, 172, 174, and 176. Step-tapered concrete piles with steel pipe bottom sections were placed by crawler rig with 5,000-lb ram and Raymond full-revolving driver with 6,500-lb ram.

PILES, CONCRETE, DRIVING. Concrete Piles Jetted to Place by Three-Load Driver. *Eng. News-Rec.*, vol. 135, no. 12, Sept. 20, 1945, pp. 371–372. Concrete piles cast in forms with 3-in. pipe down center to provide water pressure for jet action; jetting speeds driving.

PILES, STEEL. Piledriving for Guam Docks *Western Construction News*, vol. 20, no. 9, Sept 1945, pp. 108–110. Description of procedure used by Seabees in driving steel sheet piles for zig-zag bulkhead.

RETAINING WALLS, EARTH PRESSURE. Earth Pressure, F. L. Kassel. *Civ. Eng.* (London), vol. 40, nos. 469 and 470, July 1945, pp. 148–151; August, pp. 178–182 and 184. Author attempts to bring together knowledge on soil mechanics and present it in form useful to practicing engineer; definitions of active earth pressure and passive earth resistance; discussion of various factors which must be considered before calculations of earth pressure are made.

HYDROELECTRIC POWER PLANTS

INDIA. Sees India on Threshold of Great Expansion Era, S. Swayambu. *Hydro News*, vol. 32, no. 10, Oct. 1945, pp. 7–10. Highlights of water power development presented; considerations in power development include provision of storage reservoirs and river flow for irrigation purposes; design and equipment; frequency and supply voltage; hydro versus steam power; grid schemes and interconnection; rural electrification; ownership; personnel.

SOVIET UNION. Dnieper Power Station To-day. F. Loginov. *Civ. Eng.* (London), vol. 40, no. 470, Aug. 1945, pp. 175–176. Brief description of damage done by German army and reconstruction now being accomplished.

HYDROLOGY AND METEOROLOGY

RAIN AND RAINFALL. Rainfall Cycles—Factor in Planning Hydraulic Design, H. E. Goerrodette. *Western Construction News*, vol. 20, no. 9, Sept. 1945, pp. 105–106. Minor fluctuations in rainfall over short periods have been re-

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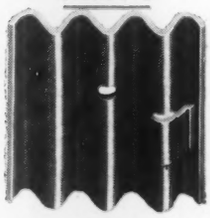

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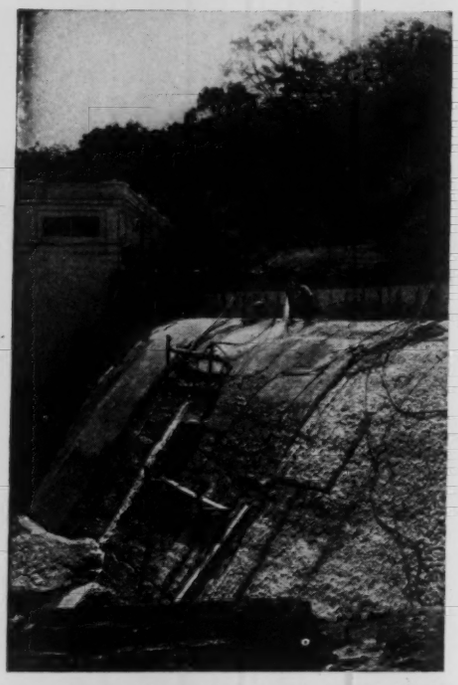

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duced to fundamental graph with which effect of rainfall upon conservation and food control can be predicted; suggestion is made that precipitation cycles may influence trend of world affairs.

RAIN AND RAINFALL. Rainfall Cycles—Factor in Planning Hydraulic Design, H. E. Goerrodette. *Western Construction News*, vol. 20, no. 9, Sept. 1945, pp. 105–106. Minor fluctuations in rainfall over short periods have been reduced to fundamental graph with which effect of rainfall upon conservation and food control can be predicted; suggestion is made that precipitation cycles may influence trend of world affairs.

RUNOFF. Infiltration and Runoff During Snow-Melting Season, with Forest-Cover, R. E. Horton. *Am. Geophysical Union—Trans.*, vol. 26, pt. 1, Aug. 1945, pp. 59–68. New method of analysis of rainfall and runoff data, which permits surface runoff and ground-water flow to be segregated and infiltration capacity determined during stream rises; determination of infiltration capacity during snow melting periods is, however, most difficult problem and method is applied to this case, using data for areas in Allegheny Experimental Forest, with varying degrees of forest cover density.

RUNOFF. Runoff from Water-Sealed Soil, L. A. Westby and L. L. Harold. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 440–441. Three storms in three days early in 1944 occurring near Waco, Tex., where clay soils swell and become sealed when subjected to considerable rain, caused floods, when 13 to 14 in. of rain fell; peak runoff rates were about 0.6 to 0.7 in. per hour less than maximum 20-min rainfall intensities, which varied up to almost 5.5 in. per hour.

IRRIGATION

BOLIVIA. Extensive Irrigation Program Planned by Bolivia. *Eng. News-Rec.*, vol. 135, no. 12, Sept. 20, 1945, p. 370. Brief note on projects planned.

NEW MEXICO. Water for New Mexico Desert, H. W. Mutch. *Western Construction News*, vol. 20, no. 9, Sept. 1945, pp. 85–88. Tucumcari Project, of Bureau of Reclamation, utilizes extensive series of siphons, tunnels, and ditches to convey water impounded by Conchas Dam on South Canadian River to irrigate over 45,000 acres of farm land in Arch Hurley Conservancy District.

MATERIALS TESTING

AIRPORT RUNWAYS. Heavy Concrete Test Section Constructed for 175-Ton Planes. *Construction Methods*, vol. 27, no. 9, Sept. 1945, pp. 102–103, 176, 178, and 180. Details on 18-in. concrete test section on well-compacted 24-in. base to support concentrated wheel loads of 175,000 lb in warm-up apron and hangar floor areas at Moffet Field, Calif.

PORTS AND MARITIME STRUCTURES

DREDGING, GUAM. Harbor Stretcher 1912–1945. *Excavating Engr.*, vol. 39, no. 9, Sept. 1945, pp. 492–495 and 524. Former Great Lakes Dredge & Dock Co. dredge, "Indiana," now working for U.S. Navy as YM-18 to build up acreage and improve harbor of Pacific Island base of Guam.

EMBANKMENTS. Consolidation of Rock Embankment to Prevent Wave Erosion, J. Johnston. *Roads & Bridges*, vol. 83, no. 9, Sept. 1945, pp. 67–69, 112–114. Causeway at Baie Comeau, Quebec, made stable against heavy seas by intrusion method.

JETTIES. Permeable Pile Jetties Stop River Bank Erosion. *Construction Methods*, vol. 27, no. 9, Sept. 1945, pp. 81, 170, and 172. Use of permeable trestle-type jetties of pressure-creosoted piles on lower Colorado River in Texas halted erosion; construction described.

PORT TERMINALS, SEATTLE. Modern Marine Terminal Built by Port of Seattle. *Wood Preserving News*, vol. 23, no. 8, Aug. 1945, pp. 72–74, and 80. Brief description of marine terminal, known as Connecticut Street Terminal Pier No. 42, which has deck area in excess of 400,000 sq ft; it is designed for live loads of 700 lb per sq ft; planned in anticipation of wartime needs, but designed for efficient peacetime operation; approximately 853,700 bd ft of timber and 389,000 lin ft of piles treated with creosote, and 874,000 bd ft of timber with chromated zinc chloride.

SHORE PROTECTION. New Method of Revetting Old Man River, A. B. Pickett. *Eng. News-Rec.*, vol. 135, no. 12, Sept. 20, 1945, pp. 390–394. New type of flexible reinforced concrete mattress developed recently by U.S. Army Engineers for revetment along Mississippi River; initial installation at Miller Bend, using mats 24 ft wide, 60 ft long, and 1⅛ in. thick proves method is successful.

WRECKAGE REMOVAL. Methods for Salvaging Explosives and Debris from Deep Tide Water. *Pac. Bldr. & Engr.*, vol. 51, no. 9, Sept. 1945, pp. 52, 56, and 58. Account of steps used in removing ship fragments and carloads of explosives from shipping lanes following Port of Chicago explosion; diving and blasting operations.

ROADS AND STREETS

ACCESS. New Roads to Critical War Supplies. *Western Construction News*, vol. 20, no. 8, Aug.

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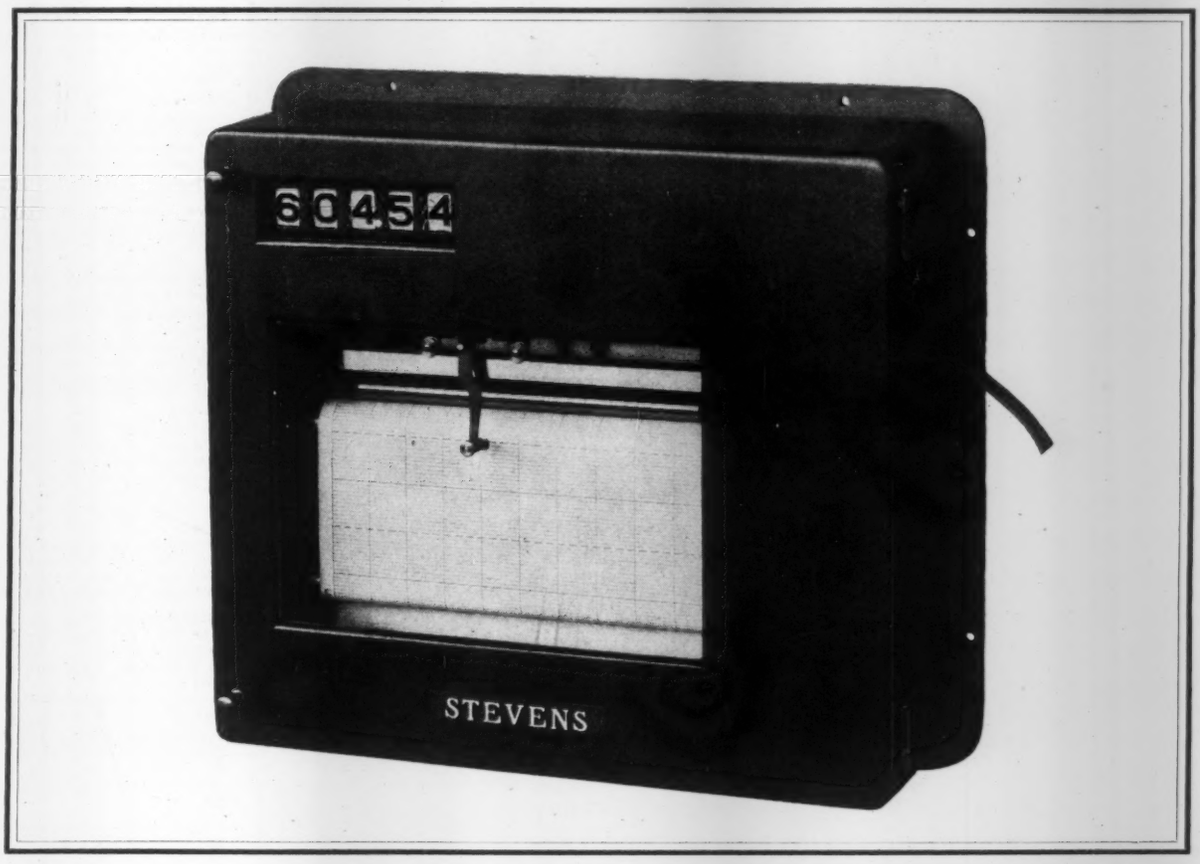

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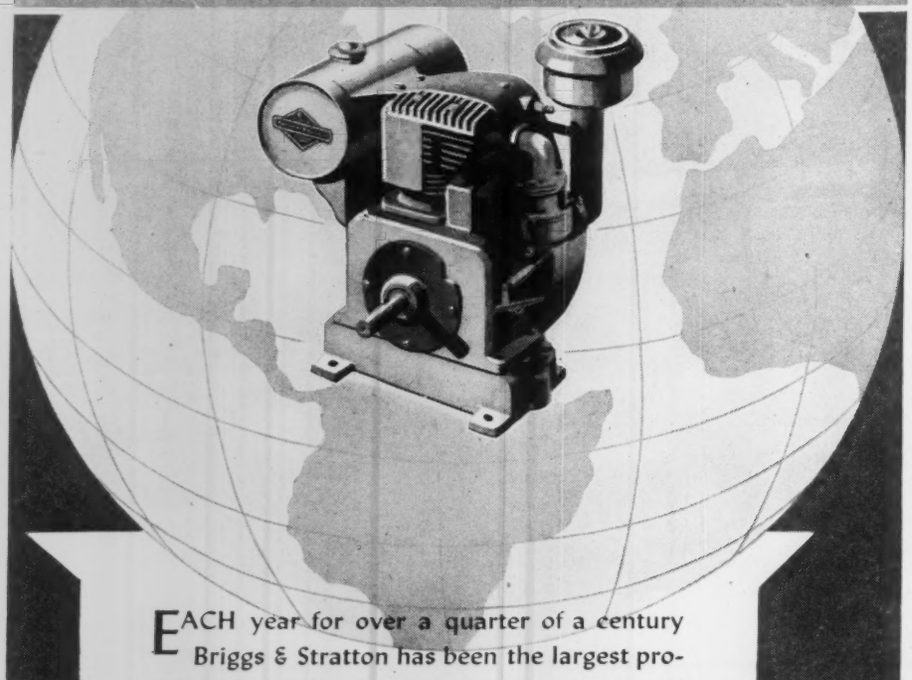

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1945, pp. 94–95. Bituminous-surfaced access roads 22 ft wide eliminate bottlenecks in transporting war-vital California timber and minerals from isolated areas to centers of industry; federal, state, and local governments, as well as logging companies, participate financially.

AIRPORT RUNWAYS, CONSTRUCTION. Visit To Nation's Heaviest Airport Grading Project, H. J. McKeever. *Roads & Streets*, vol. 88, no. 7, July 1945, pp. 74–77, 79, 81, 83, and 85. How Harrison Construction Company, of Pittsburgh, is handling 5,200,000 cu yd job at Kanawha County Airport, Charleston, W.Va.; horizontal drilling, steep haul roads, daily production of from 20 to 24,000 cu yd are among construction highlights; phenomenally heavy cuts and fills, "reverse" fill design, heavy benching, and rounded fill corners among notable engineering features; selected rock being stored for base construction.

CONSTRUCTION. All-Out Equipment Use Speeds 10½-Mile Road Job. *Roads & Streets*, vol. 88, no. 9, Sept. 1945, pp. 73–80. Job of grading four-lane arterial divided highway on new location, paving one entire side and other side at special points on U.S. 22 highway east of Harrisburg, Pa.

EMBANKMENTS. Using Cat-Dozer on Steep Grade. *Eng. & Contract. Rec.*, vol. 58, no. 9, Sept. 1945, pp. 54–56. Methods used to solve bank grading job for Ontario Dept. of Highways; Koehring clam was hitched to dozer by cable permitting maximum safety on cutting down operation, and assisting on trip up; clam moved along with dozer as it traveled along steep bank.

EXPRESSWAYS, DETROIT, MICH. Planning with You. *Arch. Forum*, vol. 83, no. 3, Sept. 1945, pp. 125–129. Plan for expressway system to eliminate downtown congestion and speed up traffic between widely separated districts.

EXPRESSWAYS, HARTFORD, CONN. New Expressways for Hartford. *Roads & Streets*, vol. 88, no. 9, Sept. 1945, pp. 91–95, 97–98. Plans for express highways described; four projects to cost $21,700,000 recommended by Connecticut State Highway Department, after comprehensive traffic studies.

FROST EFFECT. Precautions for Avoiding Frost Heaving of Pavements. *Pub. Works*, vol. 76, no. 9, Sept. 1945, pp. 22–24 and 46. Observations of pavement heaving and tests with wheel loads of 10,000 to 40,000 lb led to conclusions as to depth of gravel base necessary.

HIGHWAY SYSTEMS. Strategic Roads of World. *Roads & Road Construction*, 23, no. 272, Aug. 1, 1945, pp. 254–256. Discussion of Burma Road, China-Russia Highway, Australian Highway, Pan-American Highway, and Alaska Highway.

MILITARY ENGINEERING. Maintenance Under Traffic Builds Up Stilwell Road, W. L. O'Donnell. *Construction Methods*, vol. 27, no. 9, Sept. 1945, pp. 106–108, 192. Description of tasks involved in maintenance of road; timber production; gravel supply difficult to obtain; rebuilding bridges.

MILITARY ENGINEERING. Road Work in Bulge, W. C. Hall. *Military Engr.*, vol. 37, no. 238, Aug. 1945, pp. 324–325. Problems of surfacing drainage and repair of roads for transport on West front.

SAN ANTONIO, TEX. Postwar Arterial Highways for San Antonio, Tex. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 430–433. After study of regional and local problems, east-west and north-south four-lane, limited access highways, costing $21,000,000, were proposed to provide urban links for national system of interstate highways serving city; scenic features were taken into consideration in determining route for proposed arterials. Article prepared from report by M. Baker, Jr.

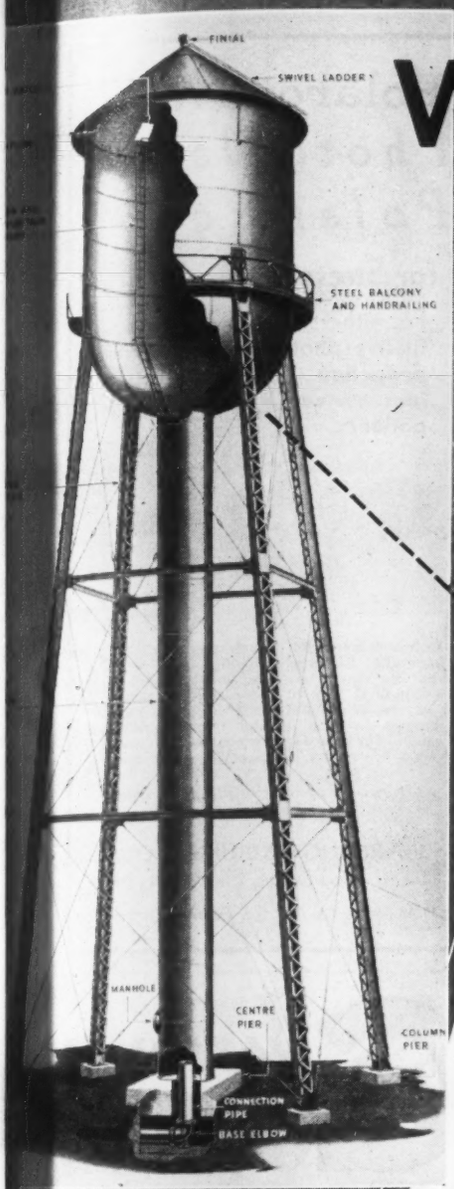
SAN FRANCISCO, CALIF. Minnatoma Project, G. S. Hill. *Architect & Engr.*, vol. 162, no. 2, Aug. 1945, p. 28–29. Description of project providing thoroughfare 230 ft wide.

SAND-ASPHALT. Sand-Asphalt Practice in Mississippi. *Roads & Streets*, vol. 88, no. 7, July 1945, pp. 67–70. Details of surface type that has proved economical in area entirely lacking in stone aggregate.

STABILIZATION. Lignin Extract as Stabilizing Agent for Road Foundations, G. Piette and G. Demers. *Roads & Bridges*, vol. 83, no. 9, Sept. 1945, pp. 70–73, 114–16, and 118. Report of tests to obtain absolute values of bearing capacity of raw gravel, stabilized gravel, and stabilized gravel treated with lignin extract.

SUBSOILS. Flexible-Pavement Foundations, N. W. McLeod. *Roads & Bridges*, vol. 83, no. 9, Sept. 1945, pp. 74–80, 102–121. Fundamentals of subgrade construction and principles of base-course design, difficulties resulting from capillary water, and recent developments in soil engineering discussed.

SWAMPS. Hydraulic Causeway Fill Replaces "Floating" Road, W. S. Winslow. *Better Roads*, vol. 15, no. 9, Sept. 1945, pp. 23–25 and 40. North Carolina is completing solid fill across more than 2 miles of swamp east of Elizabeth City to take place of unsafe and costly-to-maintain section of U.S. Route 148; fill material pumped by dredges from borrow-pits in Pasquotank River and adjacent swamp.



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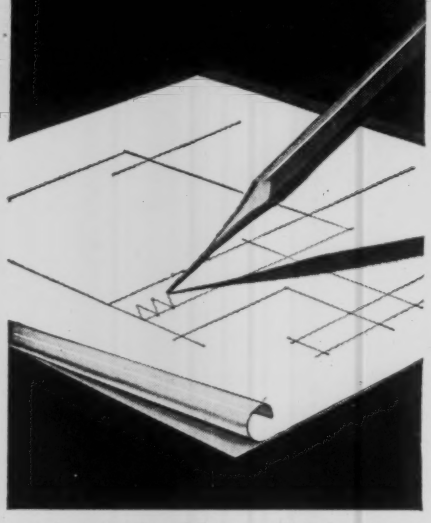

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UNITED STATES, POSTWAR PROGRAM. Postwar Highway Program, H. H. Hale. *Constructor*, vol. 27, no. 7, July 1945, pp. 77–78 and 126. Preparatory information for contractors for postwar construction discussed.

SEWERAGE AND SEWAGE DISPOSAL

SEWAGE FILTERS, COLD WEATHER OPERATION. Experiences in Winter Operation of Sewage Filters, J. C. D. Taylor. *Water & Sewage*, vol. 83, no. 9, Sept. 1945, pp. 26–28 and 45–46. Conclusions reached by R.C.A.F. Engineers after operating plants at training schools in Manitoba and Saskatchewan; comparison of covered and open filters and clarigesters.

SEWAGE TANKS. Care and Operation of Imhoff Tanks, P. N. Daniels. *Sewage Works J.*, vol. 17, no. 5, Sept. 1945, pp. 995–1000. Methods and tools used in cleaning walls, slopes, weirs, channels, and baffles; proper handling of gas vents; sludge digestion and storage chamber.

SEWAGE FILTERS, TRICKLING. Trickling Filters—Past, Present, and Future, E. S. Chase. *Sewage Works J.*, vol. 17, no. 5, Sept. 1945, pp. 929–939. Review of development of trickling filters; standard rate vs. high rate; design factors; operating factors, purification affected; future prospects.

SEWERS, GUAM. Seabees Make Materials for Guam Sewer, H. W. Richardson. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 443–446. Account of building of 3-mile sanitary sewer discharging into ocean through outfall across tide-flooded barrier reef.

TREATMENT PLANTS, GREAT BRITAIN. London Sewage Disposal Facilities After Century of Time and Two Wars, M. N. Baker. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 447–448. Account of facilities based on recent correspondence with Chief Engineer of London County Council.

TREATMENT PLANTS, SAN DIEGO, CALIF. Boom Town San Diego Solves Sewage Problem, B. D. Phelps. *Pub. Works*, vol. 76, no. 9, Sept. 1945, pp. 18–21, and 44. Operation of new plant, which includes comminutors, detritors, aeration tanks, vacuators, clariflocculators, elutriation tanks, vacuum filters, sludge dryers, and fertilizer weighing and sacking equipment.

TREATMENT PLANTS, SAN LUIS OBISPO, CALIF. Modern Sewage Works for San Luis Obispo, R. P. Howell and H. N. Jenks. *Am. City*, vol. 60, no. 9, Sept. 1945, pp. 109–110. Sewage treatment plant enlarged to meet wartime need provides irrigation for municipal sewerage farm and protects nearby creek by pollution.

TREATMENT PLANTS, NEW YORK CITY. Sludge Preheating Is Featured in New York's Sewage Plant Design. *Eng. News-Rec.*, vol. 135, no. 14, Oct. 4, 1945, pp. 449–452. Preheating of sludge in 120-mgd activated sludge plant planned for treating sewage from New York City's Borough of Bronx will eliminate digester heating coils; aluminum heat exchangers utilizing heat of engine cooling water and exhaust gases will heat sludge during pumping; plant construction may be under way early next year.

TRAFFIC CONTROL

TRANSPORTATION, MUNICIPAL. Incorporating Transit Facilities in Urban Expressways, L. Williams. *Roads & Bridges*, vol. 83, no. 8, Aug. 1945, pp. 64–65, 118–124, 126–129. Public transit service on both rubber and rails should be unified with postwar urban express highways for economy, safety, convenience, and maximum public service. Before Eng. Foundation for Highway Traffic Control.

TUNNELS

RAILROAD, COLORADO. New Colorado Railway Tunnel, K. Charles. *Western Construction News*, vol. 20, no. 8, Aug. 1945, pp. 96–97. Denver and Rio Grand Western Railway chose to drive new tunnel rather than to attempt relining job on existing bore at time of peak war traffic; completion of this new route will protect road with alternate tunnel through 10,000-ft Tennessee Pass.

WATER PIPE LINES

BRIDGE CROSSINGS. Treasure Island—Water Line Is Hung on Bay Bridge, R. R. Kennedy. *Western Construction News*, vol. 20, no. 9, Sept. 1945, p. 89–91. Increasing demands for water at Naval Station on Yerba Buena and Treasure islands required installation of new pipe line and pumping plant on San Francisco-Oakland Bay Bridge capable of supplying station with ultimate 3½ million gal daily; design and construction of project discussed.

WATER RESOURCES

GUAM. Groundwater Development on Guam, G. H. Abplanalp. *Eng. News-Rec.*, vol. 135, no. 10, Sept. 6, 1945, pp. 316–319. Adequate water supply for naval base is obtained from lens of fresh water "floating" on salt water in previous limestone formations underlying Guam; danger of salt water incursion resultant from drawdown has to be avoided and underground skimming weirs, similar to those used in Hawaii, afford best means for meeting heavy demands; in Guam climate, chlorides as high as 650 ppm are considered permissible in potable water.

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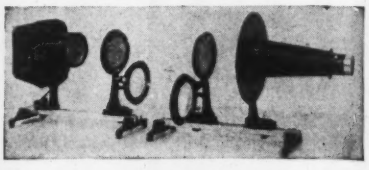

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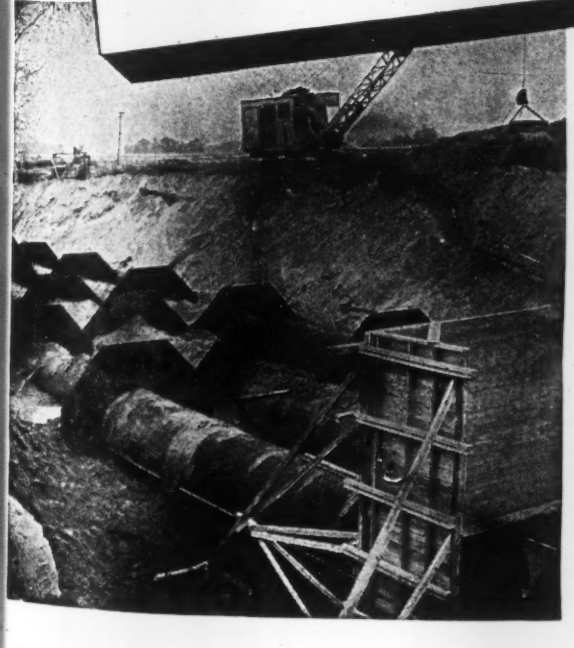

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MILITARY ENGINEERING. Surface Water Supplies on Guam, G. H. Adplanalp. *Eng. News-Rec.*, vol. 135, no. 12, Sept. 20, 1945, pp. 382–387. Description of processing facilities and chlorination techniques used on springs and surface supplies to assure high quality water to service Navy forces.

WATER TREATMENT

TASTE AND ODOR CONTROL. Chlorine Dioxide for Treatment of Water Supplies, J. A. McCarthy. *New England Water Works Assn.—J.*, vol. 59, no. 3, Sept. 1945, pp. 252–264. Discussion of experience in taste-and-odor removal by means of chlorine dioxide and account of experiments to determine bactericidal action.

TREATMENT PLANTS, OMAHA, NEBR. Water Purification Practices at Omaha, Nebr., F. B. Lasell and D. E. Johnson. *Water Works Eng.*, vol. 98, no. 18, Sept. 5, 1945, pp. 1031–1033, 1076, 1078, and 1080. Missouri River furnishes four different types of water, and each type is separate problem in water treatment; how one treatment plant has been gradually developed, through experience, to handle these four types of water satisfactorily is explained; each phase of treatment processes is brought out and need for such part of treatment procedure outlined.

WATER BACTERIOLOGY. Coliform Organism Detection as Handled at Indianapolis, C. K. Calvert. *Water Works Eng.*, vol. 98, no. 17, Aug. 22, 1945, pp. 936–937. Account of making of tests for coli-form organisms and means whereby tests have been gradually standardized in water works laboratory.

WATER BACTERIOLOGY. Tests at Omaha, Nebr., Cast Doubt on Value of Certain Media, D. Johnson. *Water Works Eng.*, vol. 98, no. 19, Sept. 19, 1945, pp. 1105–1107. In carrying out bacteriological tests on Missouri River water at Omaha, certain results were obtained that, according to standard methods, showed presence of B. coli; as other tests showed that B. coli were not actually present, desirability of using some of bacteriological tests in standard methods for Missouri River water at Omaha were questioned; details of tests and conclusions.

WATER FILTRATION, FLOCCULATION. Mechanical Flocculation of Water, N. Munro. *Water & Sewage*, vol. 83, no. 8, Aug. 1945, pp. 23, 43–44. Mechanical flocculation is argued to be effective in reducing tank volume required and in reducing amount of reagents necessary; examples given.

WATER WORKS ENGINEERING

DISTRIBUTION SYSTEMS, CALIFORNIA. How Joint Action of Nine Cities Met Greatly Expanded Water Needs, J. S. Longwell. *Am. City*, vol. 60, no. 9, Sept. 1945, pp. 121–123. New distribution facilities constructed to meet increased demand in East Bay Utilities District.

LOS ANGELES, CALIF. Experience in Supply Problems Covering Four Decades, W. W. Hurlbut. *Water Works Eng.*, vol. 98, no. 18, Sept. 5, 1945, pp. 1016–1018, 1048, 1050, and 1052. Account of problems encountered during author's experience with Los Angeles system; increase of storage; Colorado River supply; earth compaction dams.

MANAGEMENT. Good Business Methods in Small Water Plant, R. G. Yaxley. *Am. Water Works Assn.—J.*, vol. 37, no. 11, Nov. 1945, pp. 1179–1184. Operation of board of commissioners, which is independent corporate body, appointed by town supervisor, and having control of all funds and property belonging to water works.

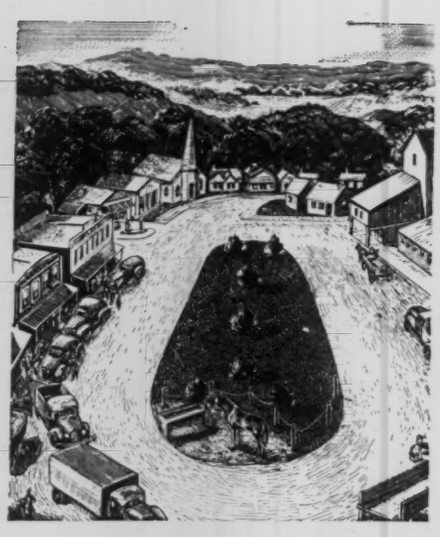
MANITOWOC, WIS. Ranney Type Collectors Solve Manitowoc's Water Problem, E. Walter and R. E. Cannard. *Am. City*, vol. 60, no. 9, Sept. 1945, pp. 112–113. Construction of collectors to replace infiltration well receiving recharge from Lake Michigan described.

OIL WELL PRODUCTION, WATER INJECTION. Injection of Water Into Underground Reservoirs in Michigan, W. E. Schoeneck. *Oil & Gas J.*, vol. 44, no. 28, Nov. 17, 1945, pp. 193–194, 198, 200, and 202. With one exception, there is no record of water injection in Michigan for purpose of secondary recovery; primary purpose has been for disposition of water to prevent pollution of lands, surface waters, and shallow water wells: exception was in Greendale field, in 1932; history and statistical data; analysis of data, with description of physical injection and its problems. Before Am. Petroleum Inst.

TOWNS. Problems of Small Town Water Works, R. E. Dillery. *Am. Water Works Assn.—J.*, vol. 37, no. 11, Nov. 1945, pp. 1185–1190. Problems in operation of Guthrie, Ky., water works.

WATER DISTRIBUTION SYSTEMS. Water Consumption and Unaccounted-for Losses, H. A. Harris, Jr. *Am. Water Works Assn.—J.*, vol. 37, no. 11, Nov. 1945, pp. 1191–1193. Data on water consumption and unaccounted-for water in region covered by California Water Service Co.

WATER TANKS AND TOWERS, ENLARGING. Enlarging Steel Water Tanks Without Dismantling. *Water & Sewage*, vol. 83, no. 8, Aug. 1945, p. 25. Method developed by Stacey Bros. Gas Construction Co.; tank is cut at bottom, floated to proper height, and then welded to new sections.



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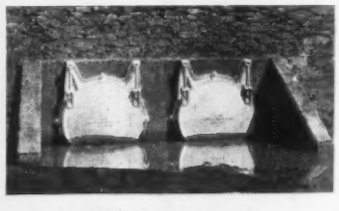

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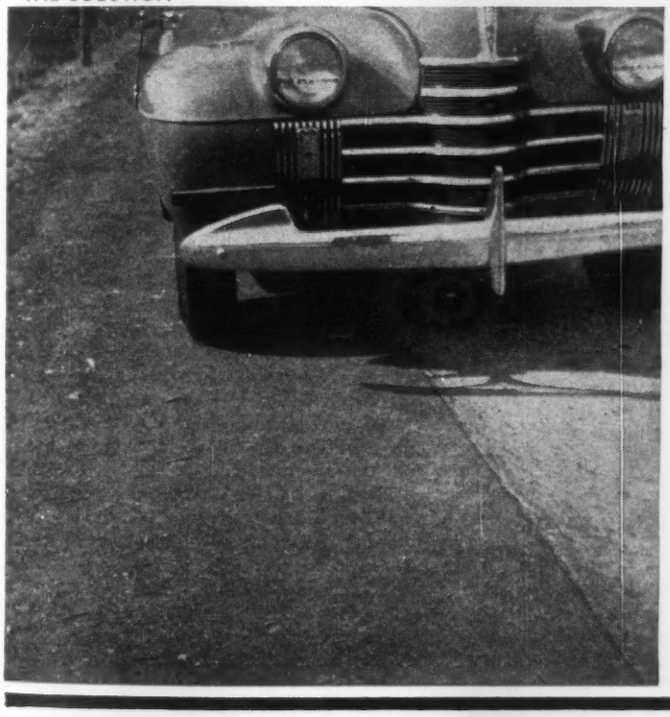

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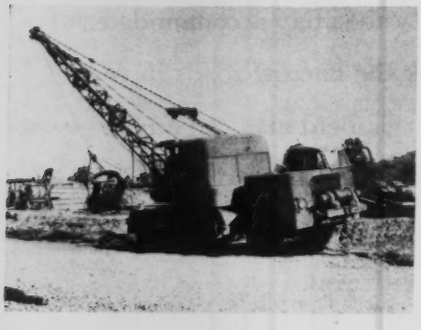
Equipment, Materials and Methods

New Developments of Interest, as Reported by Manufacturers

Crawler Shovels and Cranes

FOUR NEW HEAVY-DUTY machines, each of which incorporates features developed from wartime engineering experience are announced by The Thew Shovel Co., Lorain, Ohio. The line, designated as the Lorain "41" Series, consists of a chain-drive crawler machine and three rubber-tired machines, one with 4-wheel drive, one with 6-wheel drive, and a third of the self-propelled type.



The two-speed, crawler machine features an entirely new mounting that is longer, wider, and heavier. Standard treads are 30 in. in width and travel speeds in either direction are $^{3}/_{4}$ and $1^{5}/_{8}$ miles per hour. Steering is done from cab in any swing position of boom. Tread and travel lock is also a new development, being of the positive, 4-way ratchet and pawl type. The unit, which is convertible to shovel, crane, dragline, clamshell, or back-digger, has increased capacities.

The four-wheel drive Moto-Crane is of 20-ton capacity with specially designed 6-wheel carrier for shovel and crane loads. With ten speeds forward and two reverse, this new rubber-tired machine has a speed range of from 1 to 28 miles per hour. Travel power is supplied through two worm driven axles to four dual-tire rear wheels which are equipped with air brakes. This unit is also convertible to shovel, crane, dragline, clamshell, or back-digger.

The six-wheel drive Moto-Crane offers commercially for the first time a heavy-duty, 20-ton capacity crane that was developed for and used in military service. This crane has double-reduction drive on all axles, eight speeds forward and two reserve, and will travel from 1 to 31 miles per hour. Steering is air power assisted and air brakes are on all six wheels.

The Self-Propelled crane is of the single-engine, single-operator type and power is supplied on four worm-driven rear wheels. There are four travel speeds ranging from 1 to 7 miles per hour in both directions. The hoist, swing, travel, and boom derricking may be effected simultaneously. Steering is air powered. This 20-ton capacity unit is equipped with air brakes on four rear wheels and has dual-tired front wheels of the differential type.

New Cast-Welded Dipper

MANY OPERATORS of earthmoving equipment will be interested in the new general-purpose cast-welded dipper announced by Electric Steel Foundry of Portland, Ore., in their bulletin No. 157. The new dipper is offered in a size range from $^{3}/_{8}$ cu yd capacity to 5 yd and larger sizes on special order. It augments the well-known regular line of Esco Manganese dippers and dragline buckets.

Lighter weight is the principal advantage of the cast-welded dipper, gained through the use of manganese steel castings in the parts subjected to the most wear and shock. Many of these dippers are reported to have been built for coal stripping and loading operations and to be in service in many parts of the country.

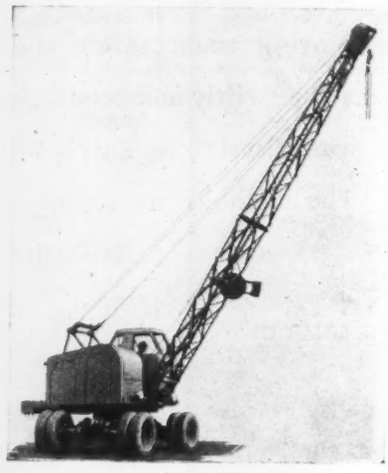
New Arc-Welding Aid

A NEW ARC-WELDING COMPOUND designed to aid in instantaneously creating and maintaining a metallic welding arc where low currents and small-diameter electrodes are employed has been announced by the Electric Welding Division of the General Electric Company. Known as Strike-easy, this new compound is easily applied and can be used on any kind of metal with any type of electrode.

The compound, which is in paste form, is available from distributors in one-pound glass jars, completely ready for use. No mixing or other preparation is required.

Power Shovel-Trench Hoe

A COMPLETELY NEW rubber-mounted, mobile crane unit, embodying power shovel, trench-hoe, dragline and clamshell, is now in production at the plant of the American Steel Dredge Company, Inc., Fort Wayne, Ind. According to the report, deliveries will start during the first quarter of 1946. The test model of the new crane is reported to have been in regular service for the past two years in the material and erection yards of a steel fabricating plant and also used by general contractors for trenching, basement excavations, drainage ditching and cleaning, and for handling sand and gravel.



The new unit will be sold under the trade name "Wayne Crane" and will be available as a crane or complete with accessory groups for use as a power shovel, trench-hoe, clamshell and dragline. Among the features which are claimed are: independent or simultaneous operation of boom, shovel or trench hoe, or propulsion mechanism; self-levelingchassis permits operation on uneven ground; full-vision cab; all machinery gears enclosed and oil-immersed; and no center-pin—the cab revolves on a 48-in. ball-race outside the swing-gear.

The power plant is a 62-hp gasoline engine which drives all four wheels and the hoisting mechanism. The hoist drums are oversize, reducing cable wear. The unit complies with all highway regulations—no permit needed to travel on public roads. Short wheel base—7 ft 8 in.—gives greater maneuverability. Four travel speeds up to 15 mph. The general specifications are: shovel, dragline and clamshell capacity $^{1}/_{2}$ cu yd; capacity of crane 4 tons at 10-ft radius; boom length crane, clamshell or dragline 30 ft; shovel and trench-hoe boom length 15 ft; weight of unit with shovel, trench-hoe, clamshell or dragline 25,000 lb prox., depending upon attachments.

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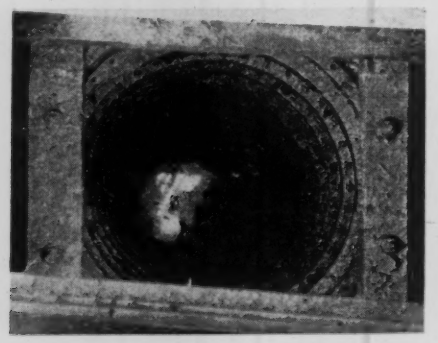

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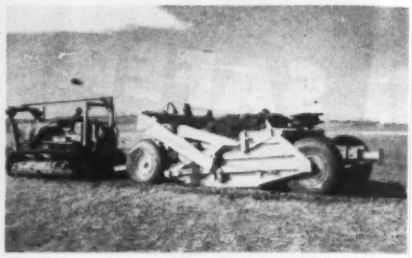
New 8½-Yard Cable Scraper

A NEW 8½-YARD postwar scraper (11 cu yd heaped) incorporating many new design features is now being offered by La-Plant-Choate Manufacturing Co., Inc., of Cedar Rapids, Iowa. A new feature of this new model (C-108) is a floating apron that adds considerably to the performance of the scraper. The apron opens 30 in. before the rear gate moves, permitting adjustment of the apron to any position before loading. Also, the apron clears the load completely as the rear gate starts to move forward, thus preventing any compaction of load between gate and apron.



The open top bowl, free of overhead obstructions, which is characteristic of La-Plant-Choate scrapers, permits loading by shovel, dragline, or elevating grader and the high lift of the apron enables the scraper to discharge any type of material from the bowel, including rock or sticky gumbo. The scraper is the front-dumping forced ejection type, designed to facilitate spreading, which is possible from ½ to 18 in. Dumping is easier and less of the tractor horsepower is utilized for dumping and spreading.

The bowl can be raised and lowered quickly due to the cam action on the bowl lift cable. Hauling characteristics of the new scraper are equally pronounced. The ground clearance of the bowl is 14 in. In digging and loading rear wheels are inside the cut at all times, yet because of the scraper's low center of gravity, effective side slope work is possible. The length of the scraper is 27 ft 3 in., width 10 ft 5 in., and height 7 ft 8 in. It weighs 14,500 lb.

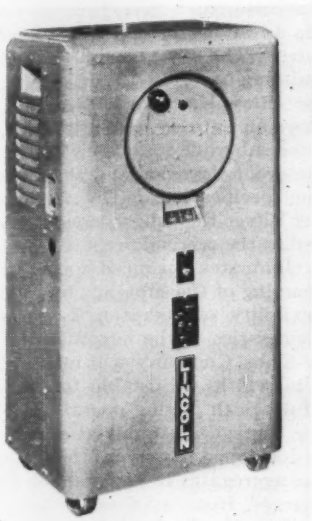
New Flexigrip Tubing Fitting

FLEXIGRIP TIME-SAVING tubing fittings which eliminate end preparation or soldering of the tubing and yet produce a stronger, leakproof and flexible joint have been announced by Gustin-Bacon Manufacturing Company of Kansas City, Mo. The Flexigrip fitting, made in standard sizes from ⅛ to 1½ in. O.D., consists of four parts—the body, a gripping ring, synthetic rubber gasket, and nut. To attach the fitting, the nut (with gasket and ring inside) is slipped over any plain-end tube, cut to desired length. The tubing end is inserted into the body as far as it will go and the nut tightened. Tightening the nut compresses the ring into a tight grip and moulds the gasket around the ring for a leak-proof seal that will withstand unusual vibration or impulse.

New Low-Priced Welder

A NEW LOW-PRICED WELDER which is said to be ideal for rural power lines has been announced by The Lincoln Electric Co., Cleveland, Ohio.

The new unit, called the "Fleet-Arc Jr.," is for 230-volt, single-phase power lines and meets the limited input requirements of rural utilities and REA by a design of high efficiency and high power factor. It has a maximum input current of 35 amperes and provides a machine which meets the new NEMA standards



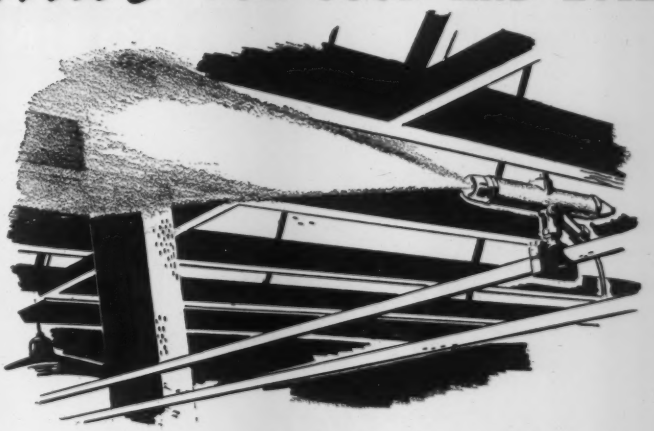
for this type of welder. It can be used with the standard 3-kva power transformer provided by the power company. Current range is from 20 amperes at 20 volts to 180 amperes at 25 volts welding duty. It will handle electrodes ranging from $^1/_{16}$ to $^5/_{32}$ in. diameter.

The "Fleet-Arc Jr." has the "Arc Booster" which provides quick, easy arc starting. The instant the electrode touches the work, the welding current is given a boost of intensity for starting the arc. The current then reverts automatically to the amount set for the job. Current control for the new "Fleet-Arc Jr." is of the separate adjustable reactance type which is varied by turning a hand wheel. Adjustment is continuous over entire welder range of from 20 to 180 amperes. "Fleet-Arc Jr." weighs only 360 lb and is readily portable.

Coating for Wood Forms

A NEW FORMULA for Formfilm, manufactured by the A. C. Horn Company, 43-36 Tenth St., Long Island City 1, N.Y., is announced. The new Formfilm allows contractors to coat the surface of plywood forms with the same thickness of film in one coat as previously obtained in two coats. The coating of plywood with Formfilm is said to produce smooth concrete, free from grain markings and ready for painting, if desired. It is claimed that Formfilm conditions the plywood so that it is highly resistant to warping or swelling because the Formfilm is highly water repellent. No concrete will adhere at any stage of drying.

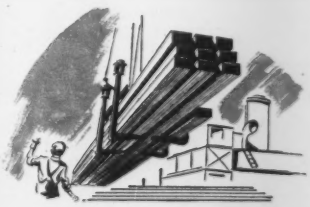
Mist FOR GOOD AND EVIL



Mist, sprayed in process plants requiring high humidity, is vital to the quality of many products. But, it raises havoc with the wood structures. And steam and chemical-laden vapors in wet process plants cause ordinary lumber to go to pieces in a hurry.

Wolmanized Lumber*, wood that's impregnated with Wolman Salts* preservative, is highly resistant to the decay that inevitably develops in these humid atmospheres. Fibre-fixation prevents its washing out or leaching, assures added years of service life.

The Advantages of Building with Wood



Building with wood means ease and speed of erection, light weight, resilience, high insulating value, paintability, low first cost and . . . when Wolmanized . . . long life.

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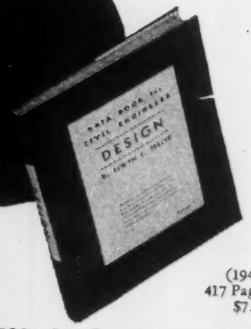

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Consulting Engineer

(1945)
417 Pages
$7.50

Nowhere else in one volume today will you find all the design data that are concentrated in this book. Over 400 pages of plates cover the main fields of civil engineering—structures, sanitation, water supply, drainage, roads, airfields, dams, docks, bridges and soils.

DATA BOOK—DESIGN will expand the field of activity of the experienced engineer and increase his versatility by providing handy information on subjects allied to his specialty. Inexperienced engineers will find this book a valuable tool, eliminating costly mistakes by supplying design data developed by an eminent consulting engineer over a period of thirty-five years.

NECESSARY DATA: The book gives all information necessary to design any of the ordinary civil engineering structures. Included are constants of nature, rules of practice, design formulas, details of engineering structures.

TIME- and LABOR-SAVING TABLES: Numerous tables are included, among them many original ones, such as curves for computing combined flexural and compressive strengths of reinforced concrete columns, etc.

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Road Builders Equipment

FOUR NEW DEVELOPMENTS, which will be of material help to roadbuilders, are announced by the Blaw-Knox Company. They include a widening finisher, a precision subgrader, a segregation eliminator, and a concrete paving conveyor.

The widening finisher intended primarily for widening work on concrete paving construction, is simple and inexpensive to operate. It is of the single screed type and can accommodate widths from 2 to 6 ft. It has two traction speeds, forward and reverse, and there are two screed speeds to allow for concrete of different textures. The same machine can be used for building concrete sidewalks.

The Blaw-Knox precision subgrader employs an entirely new principle of cutting the subgrade for paving construction to the exact elevation and shape required by the specifications. The precision subgrader leaves the subgrade as firmly compacted as the original prepared grade, and thus eliminates the need for subsequent compacting of the subgrade by rolling.

Flexibility of operation is one of the characteristics of the new machine. The Blaw-Knox Company will make it available in widths adjustable for half-width and full-width paving operations.

The segregation eliminator was originally developed to prevent the tendency of coarse aggregates to segregate as they are discharged from overhead storage bins. The eliminator is simple and inexpensive, and can be installed in each of the coarse aggregate compartments of the overhead storage bin. It is adjustable in its operation and automatic in its functioning.

Coarse aggregates, such as gravel, slag, and crushed stone, undergo segregation as they are deposited in overhead storage bins from clamshell buckets, conveyors, screens, and the like. The segregation eliminator corrects whatever segregation takes place while the bins are being filled, and delivers uniformly graded aggregate.

The multiple compartment storage bins for central mixing plants, truck mixer loading plants and batching plants for road or bridge work made by Blaw-Know will include provisions for the installations of the segregation eliminator in the coarse aggregate compartments of the storage bin, when required or specified.

The concrete paving conveyor is a portable conveyor for concrete paving construction which rides the forms ahead of the concrete paving spreader and finishing machine, receives the concrete from truck mixers, and deposits the concrete within the paving area. The conveyor receives the concrete in a collecting hopper which is cantilevered beyond the side form. There it is in a position to receive the discharge from truck mixers while they are parallel to the longitudinal axis of the paving operation. The concrete is conveyed laterally and deposited within the paving area. In half-width construction, the concrete is deposited in the center of the lane, while in full-width construction the concrete is deposited at the two quarter points. The Blaw-Knox portable conveyor materially expedites the transfer of concrete from truck mixers to the subgrade for paving construction.

Literature Available

AC ARC WELDERS—New and improved Wilson "Bumblebee" alternating current transformer arc welding machines are described fully in a 16-page illustrated booklet published by Air Reduction, 60 East 42nd St., New York 17, N.Y. Among the machines described are the 300- and 500-amp standard and all-weather models, and the new 200-amp "Bumblebee," which has been designed to meet the demands for a small arc welder comparable in performance with the big "Bumblebees." Additional sections are devoted to small transformer-type alternating current welders, running gear, remote control, and a complete line of shielded arc electrodes for a-c welding. Engineering data, complete specifications, precise labeled drawings and photographs supplement the text.

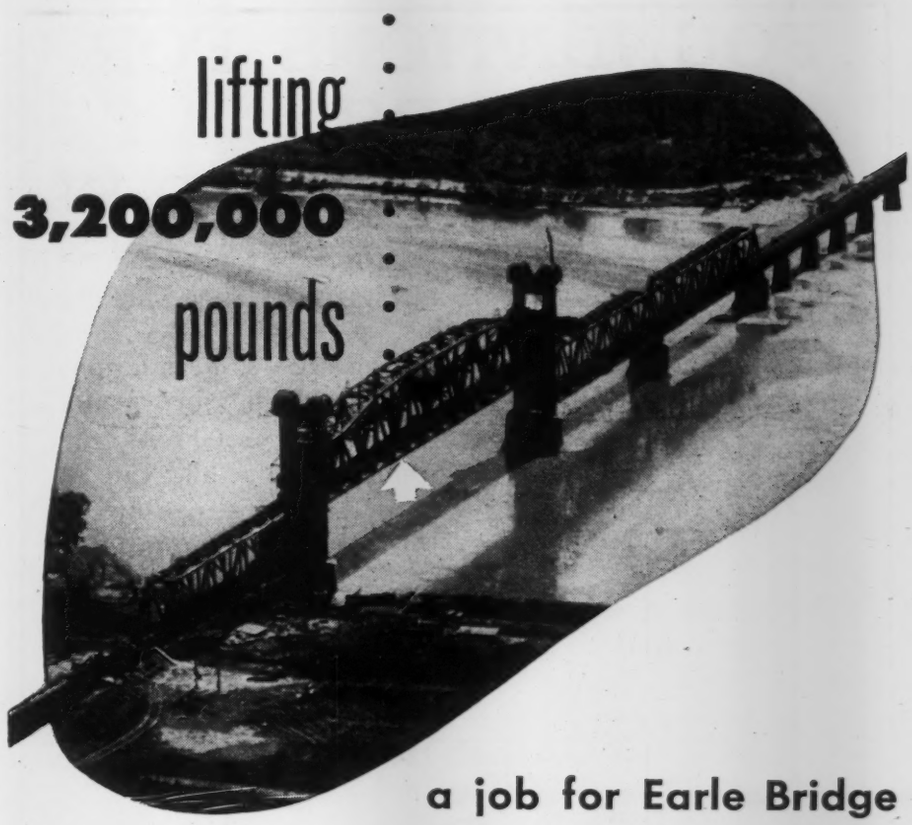
ARC WELDING ELECTRODES—"Arc Welding Electrodes," a new 32-page illustrated catalog published by Wilson Welder & Metals Co., Inc., 60 East 42nd St., New York 17, N.Y., is designed to guide electrode users in the selection of the right electrodes for any specific job. Electrodes are recommended for use on mild steel, alloy steels, low alloy high tensile steel, stainless steels and for nonferrous metals such as aluminum bronze, aluminum, and manganese bronze. Chemical analyses, specifications, and other data are supplied for each electrode.

CHART ON ALLOY WELDING—A new reference chart on high and low alloy welding electrodes is announced by Arcos Corporation, 1515 Locust St., Philadelphia 2, Pa. The data include tables on corrosion resistance, on heat resistance, and on weld metal surfacing, as well as the chemistry of the weld metal. Welding current and voltage tables give information of value to the operator. The chart is 20 × 30 in. for wall mounting.

CONTRACTORS EQUIPMENT—When there's work to be done, your "Caterpillar" dealer's place of business is the best source for obtaining a capable analysis of job requirements, the right type and size of equipment, and adequate parts and service, according to a new 12-page color booklet, Form 9148, published by Caterpillar Tractor Co., Peoria 8, Ill.

CONVEYORS—Island Equipment Corp., 101 Park Ave., New York 17, N.Y., originators of "Spot Conveying," have issued a comprehensive bulletin on their new Improved Power-Flex Unit System. It contains much information of interest on Spot Conveying, as well as on the details of this particular unit, with complete specifications and data.

GAS HOLDERS—A 50-page bulletin (W-45) giving a comprehensive picture of the design and construction of Wet Seal Gas Holders has been published by the Stacey Bros. Gas Construction Company, Cincinnati 16, Ohio. Valuable engineering data on welding technique, pressure, painting surface, corrosion and general dimensions of all sizes of gas holders up to 10,000,000 cu. ft. are discussed in detail.



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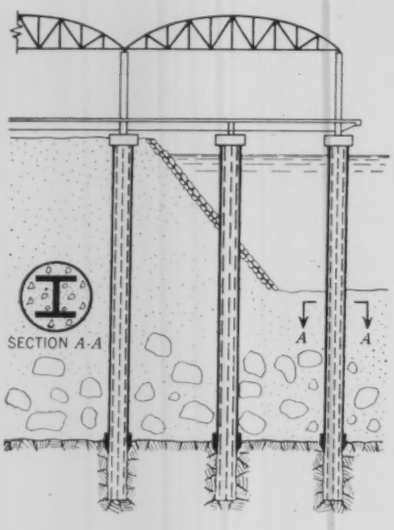

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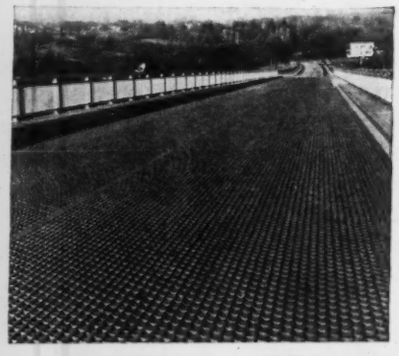

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PILE HAMMERS—To call attention to the addition of a standard line of single-acting pile hammers supplementing their line of double-acting hammers, McKiernan-Terry Corporation, Park Row Building, New York 7, N.Y., is distributing a new 16-page bulletin, No. 57, of detailed information. This bulletin describes the special purposes for which these single-acting hammers are intended, and lists a number of their superior advantages, including underwater operation. Specifications, cross-section diagrams and listing of component parts are included, also detailed data on operation. A table based on an established formula for bearing power of piles offers help in selecting the correct size of hammer.

PORTABLE PUMP MANUAL—A "Contractor's Pump Manual," designed to supply information on portable pumps and guidance to pump users in the construction, mining, and industrial fields, has been published by the Contractors' Pump Bureau of the Associated General Contractors of America, Munsey Bldg., Washington 4, D.C. Price is 50 cents per copy. Based on the experience of manufacturers regarding the characteristics of the several types of portable pumps, the manual discusses the selection of the proper kind and size of pump for the particular water-moving job at hand, and the correct operation of the pump, together with its maintenance and repair. Four types of portable pumps are presented—self-priming centrifugal; diaphragms; well-point; road pumps. In each case the pumps are described and their particular advantages and limitations outlined.

RAILROAD USES OF TIMBER CONNECTORS—The American railroad system is one of the four largest users of lumber and forest products, states a newly published booklet, "Teco Timber Connectors in Railroad Service," being distributed to railroad structural engineers by the Timber Engineering Company, 1319 Eighteenth St., N.W., Washington 6, D.C. The 20-page booklet, which is literally illustrated, cites 72 domestic roads which employ the Teco system of timber construction. Separate chapters discuss the Teco split ring, spike grid, clamping plate, shear plate, toothed ring, claw plate and their railroad applications, exterior railroad structures and buildings. Through the booklet the Timber Engineering Company invites inquiries about the research facilities at its wood products development shop and laboratory and also offers to railroad engineers typical designs of specific uses of timber connectors and sample connectors.

SAFETY AND RELIEF VALVES—A complete line of safety and relief valves is described in the new catalog No. 45, issued by the Farris Engineering Company, 400 Commercial Ave., Palisades Park, N.J. Many new valve designs and improvements in old designs are included. A "ready-reference pictorial index chart" shows line drawings of all the basic Farris valve types. With this chart a valve user can pick out the valve he needs without having to thumb through a whole catalog.